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THE UNIVERSITY OF ALBERTA

A STUDY OF READING ACHIEVEMENT OF TWINS IN GRADE ONE

by

MARY B. COSSITT

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES  
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The undersigned certify that they have read,  
and recommend to the Faculty of Graduate Studies for  
acceptance, a thesis entitled A STUDY OF READING  
ACHIEVEMENT OF TWINS IN GRADE ONE submitted by Mary  
B. Cossitt in partial fulfilment of the requirements  
for the degree of Master of Education.



## ABSTRACT

The study investigated the reading performance of identical and fraternal twins in grade one in an attempt to identify patterns of performance.

The sample consisted of six pairs of identical twins and eight pairs of fraternal twins who were selected from grade one classrooms in the City of Edmonton. A number of tests designed to reveal the presence or absence of fundamental reading skills were administered to the twins. Areas tested included perceptual skills, word recognition skills, oral reading skills, comprehension skills, and reading rate skills. Certain physical aspects of development were evaluated by auditory, visual, and lateral dominance screening tests.

Findings resulting from the analysis of the data were presented by making comparisons at three levels. The first level involved a comparison of twins with a grade one population. At the second level a comparison was made between identical and fraternal twins. Comparison at the third level examined intra-pair relationships.

Comparison of the twins with a grade one population was based on the Gates Primary Reading Tests. The mean grade score was the same for both groups. Thus, the performance of the twins on this test was typical of grade one pupils. Comparison between the two twin types revealed that generally the differences were not statistically significant, although there was a tendency for the fraternal twins to perform at a slightly higher level. Intra-pair comparisons revealed that



there was no consistent trend for pairs of one twin type to show a greater degree of correspondence than the other.

It was observed that while overall reading achievement was adequate, the evaluation of discrete abilities necessary for reading progress showed that deficiencies were present. Poor auditory and visual discrimination were evident. Similarly, word analysis skills showed inadequate development. However, despite limitations in the application of phonetic and structural analysis, the twins knew many sight words and were able to utilize context clues and consequently were able to read for general meaning.

Both twin types indicated a high incidence of hearing loss which was characteristic of one member of a pair. Mixed dominance was typical of the two groups but the identical twins tended to exhibit this trait to a greater extent than the fraternal twins.

On the basis of this study, it would seem that effective teaching of twins would involve a knowledge of problems characteristic of the group and insight into specific problems relating to individuals within the group.

While there is a considerable amount of research available relating to twins, it is characterized by the utilization of twins as a method of control so that information may be obtained concerning the participation of genetic and environmental influences in human development. There has been little emphasis on examining the characteristic features of behaviour imposed by twinship and the resulting



effects on twins themselves. Therefore, further investigations which would help identify more precisely the nature of problems relating to personality and cognitive development in twins and their significance in scholastic achievement are essential.



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## CHAPTER I

### INTRODUCTION

#### I. STATEMENT OF THE PROBLEM

While most children will respond to reading instruction and progress normally through the reading program, a large number of them will not achieve optimum growth in this important area of learning. A constellation of factors will be operative in causing difficulty in developing the skills and abilities necessary for successful reading.

In recent years there has been an increasing trend to identify groups of children who experience difficulties which intensify the problem of learning to read. Contributions from research have been particularly helpful, not only in the identification and description of deviant groups, but also in the provision of specific techniques for teaching children belonging to these groups. Among the groups so identified and provided for are, hard-of-hearing children, minimally brain-damaged children, and children whose home environment has prevented them from developing a cultural background which is essential to school progress.

There is general agreement that twins differ from single-born children and these differences are not favourable to the twins. However, there has been little concern on the part of educators with the limitations imposed by twinship.



It has been indicated from various sources that twins are intellectually inferior to single-born children. This finding is based upon a number of investigations carried out in several countries and involving large groups of different ages.<sup>1</sup> Individual differences, of course, exist, and although twins as a group tend to be intellectually inferior, such retardation is not characteristic of all twins. Nevertheless, the prevalence of inferior intellectual status among twins suggests that they are at a disadvantage when compared with a group of single-born children.

Twins experience a unique social situation in that they are exposed to the same environment at approximately identical stages of development. As a consequence of sharing their environment, twins develop a close social-personal relationship. One of the effects of this relationship is the development of a communication system which is adequate for the twins but which presents a problem when they wish to transmit the same meanings to someone else.<sup>2</sup> As a result, it is possible that twins may not share the wealth of experiences necessary for normal language growth to the degree that single-born children may do so.

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<sup>1</sup>Torsten Husen, Psychological Twin Research: A Methodological Study (Stockholm: Almqvist and Wiksell, 1959), pp. 32-55; and Scottish Council for Research in Education, Social Implications of the 1947 Scottish Mental Survey (London: University of London Press, 1953), pp. 135-157.

<sup>2</sup>Edith A. Davis, The Development of Linguistic Skill in Twins, Singletons with Siblings, and Only Children from Age Five to Ten Years (Minneapolis: University of Minnesota Press, 1937), p. 165.



Comparatively little research has been done relating to the scholastic achievement of twins. However, a recent investigation in Sweden involving 1090 twins at eleven years of age found that the twins were inferior in general scholastic attainment when compared with a random sample of 370 single-born children.<sup>3</sup> In addition to possible inferior mental development, the probability that twins may miss more time from school than single-born children could account for lack of academic achievement. The assumption that twins may be prone to absenteeism is not unreasonable in view of the fact that twins are usually weaker at birth than single-born children and physical weakness may be characteristic of them for some years after birth.

A phenomenon frequently observed among twins is their tendency to left-handedness, and although the findings from research are conflicting, there is a trend which suggests possible dominance problems among twins. Whether or not this factor contributes to reading disability is not known but it is often characteristic of poor readers.<sup>4</sup>

Problems such as those just cited and which seem to arise from twinship suggest that a study of the reading ability of twins could

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<sup>3</sup>Torsten Husen, "Intra-pair Similarities in School Achievement of Twins," Scandinavian Journal of Psychology, IV (June, 1963), 110-111.

<sup>4</sup>Albert J. Harris, How to Increase Reading Ability (New York: David McKay Co. Inc., 1961), p. 254.



reveal findings which would help clarify the status of twins in an important area of learning.

Success in initial classroom instruction is more important than providing remedy after failure. This is particularly true in learning to read since reading is the basis for later school achievement. If needs are identified and provided for in initial classroom instruction, much reading difficulty might be prevented. Therefore, an examination of the reading ability of twins at the grade one level would provide opportunity at an early stage to minimize possible existing weaknesses.

## II. PURPOSE OF THE STUDY

The purpose of this study is to investigate the reading performance of both identical and fraternal twins in grade one and to attempt to identify patterns of performance.

## III. DEFINITION OF TERMS

### Identical Twins

Identical twins are developed from a division of a single ovum which has been fertilized by one spermatozoon. The resulting two separate ova usually share a common placenta and are enclosed in a single amniotic sac. Regardless of how they develop, they carry the same assortment of genes and are always of the same sex, two boys or two girls. Because of their identical hereditary endowment



identical twins resemble each other closely in all their hereditary traits and have the closest degree of kinship possible for two distinctly separated individuals. In addition, close similarity of heredity is usually paralleled by close similarity of environment.

Identical twins are referred to also as monozygotic or MZ pairs.

### Fraternal Twins

Fraternal twins are developed from the independent fertilization of two ova by two different spermatozoa. The two ova usually have separate placentas and amniotic sacs. Similarly, the two ova have different genes and may be of the same or different sexes. Since fraternal twins are distinct in their hereditary characteristics they may not resemble each other as closely as identical twins, and usually are not more alike than ordinary siblings. Because of similarity in age, fraternal twins are more likely to share the same environment to a greater extent than ordinary siblings of different ages.

Fraternal twins are referred to also as dizygotic or DZ pairs.

## IV. HYPOTHESES

The following null hypotheses were tested in this study.

1. There is no significant difference between the twins in this study and the grade one population for the City of Edmonton in reading achievement.



2. There are no significant differences between identical twins and fraternal twins in perceptual skills, word recognition skills, oral reading skills, comprehension skills, and reading rate.

3. There are no significant differences between identical pairs or between fraternal pairs in perceptual skills, word recognition skills, oral reading skills, comprehension skills, and reading rate.

## V. QUESTIONS

In addition to the above hypotheses this study attempted to answer the following questions.

1. What patterns characterize the performance of identical twins as a group as compared with fraternal twins as a group on the auditory, visual, and lateral dominance screening tests?

2. What patterns characterize the intra-pair performance on the auditory, visual, and lateral dominance screening tests?

## VI. PLAN OF THE STUDY

In order to carry out the purpose of the study a number of tests were administered to the twins so that specific information relevant to abilities essential for reading achievement could be obtained.



Certain physical aspects of development were evaluated by auditory, visual, and lateral dominance screening tests. Other areas tested included perceptual skills, word recognition skills, oral reading skills, comprehension skills, and reading rate skills.

The results of the tests were analyzed so that reading patterns characteristic of twins could be identified. The analysis involved comparisons at three levels. The first level involved a comparison of twins with a grade one population. At the second level a comparison was made between identical and fraternal twins. Comparison at the third level examined the relationship within pairs.

## VII. LIMITATIONS OF THE STUDY

The limitations of this investigation are:

1. The sample was limited to a small representation of the twin population.
2. The determination of zygosity was based on reports of the parents of the twins and a "similarities method" of diagnosis. It is possible therefore, that the zygosity of the twins may not have been determined with complete accuracy.
3. The subjects were exposed to the same basic reading program and similarity of teaching techniques.



## VIII. SIGNIFICANCE OF THE STUDY

Initiation of procedures to offset inhibiting hereditary and environmental factors which would affect reading progress depends on an awareness of the existing problems and the extent to which they constitute a barrier to successful reading. In addition, it is important to identify those groups of children who would exhibit symptoms which would cause difficulty in learning to read.

During the past few years, much attention has been focused on special education for atypical groups, for example, the culturally deprived, the neurologically impaired, and the emotionally disturbed. Despite the fact that twins form an atypical group, little has been done to investigate their school achievement and to identify possible problem areas. Previous investigations relating to twins suggest that they may have many and varied problems which would warrant further study.

It has been estimated that twinning occurs once in eighty-seven births.<sup>5</sup> The Alberta Bureau of Vital Statistics states that there were 38,467 births<sup>6</sup> in the Province during 1963 and 362<sup>7</sup> of

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<sup>5</sup>Elizabeth B. Hurlock, Child Development (New York: McGraw-Hill Book Co., Inc., 1956), p. 61.

<sup>6</sup>Department of Health, Annual Report of the Department of Public Health Including Vital Statistics Division, (Edmonton, Alberta: Queen's Printer, 1965), p. 13.

<sup>7</sup>Ibid., p. 109.



these were live twin births. These figures indicate that approximately two per cent of the children born during these years were twins. Admittedly, this percentage represents a small part of the population, but in terms of this percentage representing an atypical group, it would seem sufficiently large to consider examining the characteristics of the group, particularly in view of the fact that research has shown some of the characteristics to be of an unfavourable nature. Therefore, it is realistic to assess twin development in an important area, that of school achievement. It is perhaps even more pertinent to measure their ability in a critical area of learning, that of reading.

It is hoped that this study will contribute to the identification of possible existing problems relating to the reading achievement of twins, as well as to a clarification of those areas which might require further research.



## CHAPTER II

### REVIEW OF THE RESEARCH

Over fifty years ago, Francis Galton published Inquiries Into the Human Faculty and Its Development.<sup>1</sup> In this volume he described the advantages to be derived from the study of twins in facilitating research regarding the effects of heredity and environment upon individuals. Galton's suggestions and preliminary work precipitated a large number of twin studies pertaining to psychological and physiological development. Many of these are based on the method of co-twin control, which is an efficient method of measuring the effects of certain environmental factors upon human growth. Gesell and Thompson,<sup>2</sup> Hilgard,<sup>3</sup> McGraw,<sup>4</sup> and McNemar,<sup>5</sup> have carried out investigations using co-twin control. This method provides

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<sup>1</sup> Francis Galton, Inquiries Into the Human Faculty and Its Development (London: MacMillan Co., 1907), pp. 155-173.

<sup>2</sup> Arnold L. Gesell and Helen Thompson, "Twins T and C from Infancy to Adolescence: A Biogenetic Study of Individual Differences by Methods of Co-Twin Control," Genetic Psychology Monographs, XXIV (1941), 1-123.

<sup>3</sup> J. R. Hilgard, "The Effect of Early and Delayed Practice on Memory and Motor Performances Studied by the Method of Co-Twin Control," Genetic Psychology Monographs, XIV (1933), 493-567.

<sup>4</sup> Myrtle B. McGraw, Growth: A Study of Johnny and Jimmy (New York: D. Appleton-Century Co. Inc. 1935), 319 pp.

<sup>5</sup> Quinn McNemar, "Twin Resemblances in Motor Skills and the Effect of Practice Thereon," Journal of Genetic Psychology, XLII (March, 1933), 70-99.



relatively identical conditions for both members of an identical twin pair, except that one twin of a pair is given a specific form of training which constitutes the experimental variation. In this way it is possible to determine changes in behaviour attributable to specified training, or conversely, how much similarity in development is maintained in spite of differences in training.

Other studies which utilize twins are based on the twin-study method and their characteristic feature is an attempt to control environmental factors, thus making possible to note whether genetic factors alone will produce variations in the phenomenon under study. The underlying assumption in these investigations, namely, that the possible effects of environment have been adequately controlled, have not always been justified. Nevertheless, research involving this method has been carried out with interesting results in many fields, including intellectual development,<sup>6</sup> personality structure,<sup>7</sup> and mental disorders.<sup>8</sup> In order to assess more adequately the effects

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<sup>6</sup>Ruth Byrns and J. Healy, "The Intelligence of Twins," The Pedagogical Seminary and Journal of Genetic Psychology, XLIX (1936), 474-478.

<sup>7</sup>H. von Bracken, "Mutual Intimacy in Twins: Types of Social Structure in Pairs of Identical and Fraternal Twins," Character and Personality, II (June, 1934), 293-309.

<sup>8</sup>Gordon Allen and Franz J. Kallman, "Frequency and Types of Mental Retardation in Twins," American Journal of Human Genetics, VII (March, 1955), 15-20.



of observed environmental differences on the behavior of twins, several investigations have attempted to make comparisons among identical twins reared together, fraternal twins reared together, and identical twins reared apart. Identical twins reared apart are rare and consequently studies dealing with them are also rare. Typical of individual case studies of two members of a twin pair are those presented by Burks<sup>9</sup> and Saudek.<sup>10</sup> Investigations of larger groups and subsequent reports have been made by Newman, Freeman, and Holzinger,<sup>11</sup> and Shields.<sup>12</sup>

As indicated from these approaches, the purpose of twin studies generally is to obtain evidence relating to the participation of genetic and environmental influences in causing variability in human development. Thus, despite hundreds of studies involving twins there has been little emphasis on examining the characteristic features of behaviour imposed by twinship and the resulting effects on twins themselves. However, in an incidental manner, the literature

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<sup>9</sup>Barbara Burks, "A Study of Identical Twins Reared Apart Under Differing Types of Family Relationships." Quinn McNemar and Maud Merrill (editors), Studies in Personality, (New York: McGraw-Hill, 1942), 35-69.

<sup>10</sup>R. Saudek, "A British Pair of Identical Twins Reared Apart," Character and Personality, III (September, 1934)17-19.

<sup>11</sup>Horatio Newman, Frank Freeman, and Karl Holzinger, Twins: A Study of Heredity and Environment (Chicago, Illinois: University of Chicago Press, 1937), 369 pp.

<sup>12</sup>James Shields, Monozygotic Twins: Brought Up Apart and Brought Up Together (London: Oxford University Press, 1962), 264 pp.



has produced sufficient information about twin development so that conclusions can be drawn regarding their behavioural status in certain areas which would affect academic achievement.

The following review examines studies which are representative of those carried out in four areas considered pertinent to this investigation. These areas are: Intelligence of twins, language development of twins, school achievement of twins, and laterality of twins. It is generally agreed that intelligence and linguistic ability are two factors which have a significant bearing on learning to read. Any information available from research relating to the functioning of twins in these areas provides a useful background for this study. Similarly, knowledge derived from research about the school achievement of twins provides a framework in terms of expected development. It is not known to what extent, if any, laterality affects reading progress, but it is a fairly common observation that children who experience reading difficulties also have laterality problems. Since left-handedness appears to be a frequent phenomenon among twins, it was decided to include in this review a number of studies relevant to left-handedness in twins.

## I. INTELLIGENCE OF TWINS

Investigations relating to the intelligence of twins are for the most part, characterized by consistency in results. Thus trends are easily discernible in the findings from these studies. In



general, the investigations have focused on the degree of similarity between identical twin pairs and fraternal twin pairs, but other comparisons have not been ignored. Thus, information is available concerning the intellectual status of twins as it compares with a normal population. In addition comparisons between identical twins as a group and fraternal twins as a group have been made. The results of the research indicate that twins are intellectually inferior to singletons, but there is no conclusive evidence as to which twin type more nearly approaches a normal population. The closer correspondence between identical pairs as compared with fraternal pairs has been found in many studies.

Since the primary purpose of examining the intellectual development of twins has been to determine the relative contributions of genetic and environmental factors to mental development, the findings have been interpreted within this frame of reference. Nevertheless, research has revealed valuable information and observations regarding the intellectual status of twins.

#### Comparison with a Single-Born Population

That twins are intellectually retarded when compared with a normal population has been repeatedly established in large groups of different age levels studied in several different countries. It is interesting to note that this trend was not too obvious in early twin studies.

In 1925 Lauterbach examined 208 pairs of twins with the



National Intelligence Test and the Terman Group Test of Mental Ability. He concluded that the twins were not intellectually handicapped, although the median I.Q. for the twins was 95.<sup>13</sup> The findings from a later study by Wingfield and Sandiford involving 102 pairs of twins showed similar results. The investigators reported that while the twins were below the average for the population in general, the difference was very slight. Also, the twins showed the same degree of variability as unselected children.<sup>14</sup>

As a result of findings such as these, it was generally held that twins were not intellectually inferior to single-born children. But from the 1930's to the present time, research has continually demonstrated that there can be little doubt that twins are, in actual fact, intellectually inferior to a normal population.

One hundred twenty-three of Day's twins were given the Minnesota Pre-School Scale. The scores obtained by the twins on this test produced a range in I.Q. scores from 59 to 138.<sup>15</sup> A comparison of the mean I.Q. of the twins with the singletons from McCarthy's

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<sup>13</sup>C. E. Lauterbach, "Studies in Twin Resemblance," Genetics, X (November, 1926), 525-568.

<sup>14</sup>A. H. Wingfield and P. Sandiford. "Twins and Orphans," Journal of Educational Psychology, XIX (September, 1928), 419.

<sup>15</sup>Ella J. Day, "The Development of Language in Twins: II. The Development of Twins: Their Resemblances and Differences," Child Development, III (Dec., 1932), 300.



study<sup>16</sup> when matched for age and sex revealed that except for two year old and five year old girls, the twins indicated retarded intellectual status.<sup>17</sup>

During a large scale testing program of high school students in the United States, the Henmon-Nelson Test of Mental Ability was administered to 119,850 students. From this number 412 pairs of twins were identified and their test scores examined in relation to the larger group. The mean score of the twins fell approximately at the 40th percentile of the entire sample.<sup>18</sup>

In the 1947 Scottish Mental Survey, 525 pairs of twins were identified from a total population of 75,451 children included in the survey. The mean age for both groups was 131.4 months. Intelligence test scores were available for 974 twins and these scores were compared with those of 69,831 children who were single-born. The test administered to the children was especially prepared for the survey and the results are in terms of test scores rather than intelligence quotients. The possible range of scores was from 0 - 76. The mean score for the twins was 31.92 with a standard deviation of 16.52 and the mean score for the control population was 36.75 with a

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<sup>16</sup>Dorothea A. McCarthy, Language Development of the Preschool Child, University of Minnesota Institute of Child Welfare Monograph, No. 4 (Minneapolis: University of Minnesota Press, 1930), 174 pp.

<sup>17</sup>Day, loc. cit.

<sup>18</sup>Ruth Byrns and J. Healy, "The Intelligence of Twins," The Pedagogical Seminary and Journal of Genetic Psychology, XLIX (1936), 475.



standard deviation of 16.03. The difference of 4.83 between the means of the two groups was statistically significant and supported previous findings that twins as a group tend to be intellectually inferior to singletons. An examination to determine if possible differences between test scores of the twins and single-born children were due to environmental conditions, for example, family size, socioeconomic status, failed to produce evidence that these were significant factors in differentiating the two groups.<sup>19</sup>

The Swedish survey involving 2,935 Swedish male twins was carried out by Husen. The data were collected over an extended period from 1948 to 1951 when certain year groups appeared before the induction board for National Service. The average age of the inductees was twenty years.

The investigation showed that the twin population of all the year groups had a lower intelligence test score average than did the total population. The difference amounted to approximately 7.6 raw scores or about 4 intelligence quotient scores. There were nearly twice as many twins as singletons with intelligence quotients below 75. However, the difference between the twins and singletons with regard to intelligence quotients above 127 was not significant.

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<sup>19</sup>Scottish Council for Research in Education, Social Implications of the 1947 Scottish Mental Survey (London: University of London Press, 1953), pp. 135-157.



An analysis of the distribution of scores indicated that the difference resulted largely from a greater proportion of twins with low scores.<sup>20</sup>

The intellectual retardation of twins as observed in a number of investigations has aroused comments as to possible explanations for this phenomenon. Husen suggests that the general physical weakness of twins at birth may account for the difference between twins and singletons. He suggests also that brain lesions possibly occur more often in twins not only at birth, but also prenatally, thus handicapping the twins.<sup>21</sup> Price maintains that certain factors operate in the development of twins prenatally which do not differ in kind, but do differ in degree from the analogous conditions for single-born children, for example, special conditions of placentation, position "in utero," crowding and delivery.<sup>22</sup> Anastasi agrees that the uterine environment of twins differs in degree from that of singletons, and this difference may impose restrictions on mental development.<sup>23</sup> Whether or not the imposition of an intellectual

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<sup>20</sup>Torsten Husen, Psychological Twin Research: A Methodological Study (Stockholm: Almqvist and Wiksell, 1959), pp. 19-38.

<sup>21</sup>Ibid., p. 35

<sup>22</sup>Bronson Price, "Primary Biases in Twin Studies: A Review of Prenatal and Natal Difference Producing Factors in MZ Pairs," American Journal of Human Genetics, II (Sept., 1950), 293-352.

<sup>23</sup>Anne Anastasi, Differential Psychology (New York: The MacMillan Co., 1958), p. 290.



handicap results from twinning as such, or to factors about which there is no adequate information at present is not known, but the question does suggest that further inquiry could produce worthwhile results.

### Intra-pair Resemblance

Ordinary brothers and sisters show a moderate degree of resemblance in intellectual status, as represented by correlations of approximately .50 to .60.<sup>24</sup> Fraternal twins are no more alike genetically than ordinary siblings, for they develop from separate ova. On a genetic basis, therefore, fraternal twin correlations should be of the same order as coefficients for sibling resemblance. In fact, they tend to range slightly above. The highest degree of similarity is found for identical twins.

The following studies are representative of those which examined the degree of similarity between identical twin pairs and fraternal twin pairs.

In the Day investigation correlation coefficients were computed in order to compare intellectual resemblances between pairs. The identical twins proved to resemble each other closely as evidenced by a correlation of .92. Like-sex fraternal and unlike-sex fraternal indicated some dissimilarity when compared with identical twins.

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<sup>24</sup>Harold E. Jones, "The Environment and Mental Development," Leonard Carmichael (ed.), Manual of Child Psychology (New York: John Wiley and Sons, Inc., 1954), 631-696.



The correlation coefficients for these groups were .61 and .73, respectively.<sup>25</sup>

Newman, Freeman, and Holzinger found there was an average difference in I.Q. of 9.9 points for pairs of fraternal twins, and 5.9 points for pairs of identical twins. These values corresponded to correlation coefficients of .63 for fraternal twins and .88 for identical twins. The persistent similarity of identical twins was further demonstrated by a correlation coefficient of .76 for identical twins reared apart. These figures resulted from statistical corrections for age and for inequalities in I.Q. range and were not the original figures stated in the study.<sup>26</sup>

Close correspondence between identical twins was found by Burt as represented by a correlation of .86. However, the correlation for fraternal twins in his investigation more nearly approached the predicted amount for ordinary siblings as shown by a coefficient of .54.<sup>27</sup>

The Scottish Mental Survey classified the twins according to like and unlike sex and the correlations obtained for these two groups were .73 and .63 respectively. The like-sex group would

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<sup>25</sup>Day, op. cit. p. 310

<sup>26</sup>Karl Holzinger, "Reply to Special Review of 'Twins'," Psychological Bulletin, XXXV (June, 1938), 436-444.

<sup>27</sup>Cyril Burt, "Ability and Income," British Journal of Educational Psychology, XIII (June, 1943), 83-98.



contain some identical twins and it is significant that this is the group which tended to show the greater similarity.<sup>28</sup>

The findings from the Swedish survey indicated the general trend of research in the intellectual resemblance of twins. The intra-class correlation for identical twins was .90 and for the fraternal twins the corresponding value was .70.<sup>29</sup>

Analysis of the sub-tests revealed that the verbal tests tended to yield a high correlation (above .80) and a significantly lower correlation (.63) for the non-verbal test for the identical twins. For the fraternal twins, the difference was considerably less. In discussing the correlations obtained from the sub-tests, Husen states:

...the explanation appears to be that hereditary factors play a somewhat more prominent role for the scores in the Matrix Test than for example, in the Synonym Test. It appears probable that the "tendency towards uniformity" in the MZ pairs is considerably higher than in the DZ pairs. The more loaded with experience an achievement is, the more pronounced the similarity within the MZ pairs, while the similarity within the DZ pairs does not increase to a corresponding degree, because their common experience is less.<sup>30</sup>

A qualitative analysis of responses to test items by twins was made by Rife.<sup>31</sup> That identical twins appear to be more similar

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<sup>28</sup> Scottish Council for Research in Education, op. cit., p. 144.

<sup>29</sup> Husen, op. cit., p. 52.

<sup>30</sup> Ibid., p. 55.

<sup>31</sup> D. C. Rife, "Twin Differences in Intelligence," Journal of Educational Psychology, XXVI (Dec., 1935), 709-712.



qualitatively than fraternal twins was found when a comparison was made between these two groups of the kinds of replies to various test items. Rife concluded that the closer correspondence between the identical twins indicated that identical twins apparently are similar in kind as well as amount of intelligence. He suggested that these similarities may not be the result of a genetic factor entirely, but could be the result of greater similarity of environment for identical as opposed to fraternal twins.

The difference between identical twin and fraternal twin correlations may result either from hereditary factors or from the still closer similarity in environment of the identical twin pairs. The fact that identical twins maintain a closer resemblance than fraternal twins, even when separated early in life and reared apart suggests that strong genetic factors are operative. However, it is interesting to note that identical twins reared apart have, in many instances, been brought up in fairly similar environment. It has been found that where the environments differed to a great extent, there was a corresponding difference in intellectual status.<sup>32</sup>

Because fraternal twins are more alike than ordinary siblings, it is assumed that environment must play a strong part in the determination of intelligence. The influence must be environmental because from a genetic standpoint fraternal twins are no more alike

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<sup>32</sup>Newman, Freeman, Holzinger, op. cit., p. 340



than ordinary siblings. They do however, share a common intra-uterine environment and one subjected in common to any congenital effect due to the mother's nutritive or glandular condition during pregnancy. The prenatal condition is a potential environmental influence upon their development. They also share an environment after birth which is more alike than that for ordinary siblings. While the social environments of the two members of a pair of fraternal twins are unlike in any way the twins happen to be unlike, their environments tend to be more alike than those of ordinary siblings and somewhat less similar than those of identical twins.

#### Intra-group Comparisons

Few investigations give information relating to differences between identical and fraternal twins in intellectual development. A number of studies make comparisons between twins of like-sex and twins of unlike-sex. Twins of unlike-sex would include all fraternal pairs, and twins of like-sex would include identical and fraternal pairs. Thus, much of the data available from these investigations are difficult to assess and strict interpretation of findings is not possible.

Day divided her sample into identical twin pairs and fraternal twin pairs. On the basis of the test used to assess intelligence, identical twins proved to have higher I.Q.'s than fraternal twins. The mean I.Q. for identical twins was 99.7 and the mean I.Q. for fraternal twins was 92.8. Day also reworked data from



earlier studies by Merriman and Wingfield and Sandiford and obtained similar results.<sup>33</sup> The same trend was noted in the Newman, Freeman, and Holzinger investigation in which the mean I.Q. for identical twins was 101.6 and the mean I.Q. for the fraternal twins was 96.1. The difference which favoured the identical twins was significant.<sup>34</sup>

In the Wisconsin project classification of twin types was based on like- and unlike-sex groups. Neither twin group scored as high as the singletons used in the study, but the unlike-sex twins were closer to the median percentile than were the like-sex twins.<sup>35</sup> It is significant that the unlike-sex group would not contain any identical twins. The superiority of the unlike-sex group would tend to offer some basis whereby previous research indicating the superiority of identical twins could not be considered conclusive and suggests that further research is necessary.

### Summary

The evidence from research suggests that twins tend to be intellectually inferior to singletons.

Correlations between identical twins are high, generally in the .80's and .90's, while correlations between fraternal twins

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<sup>33</sup>Day, op. cit. p. 301.

<sup>34</sup>Newman, Freeman, and Holzinger, op. cit., p. 101.

<sup>35</sup>Byrns and Healy, op. cit., p. 478.



are lower, about .60 to .70. Correlations between fraternal twins, however, are higher than correlations between ordinary siblings.

Research relating to differences between identical twins as a group and fraternal twins as a group is meagre, and is limited to early studies. There appears to be a trend for the identical twins to be superior intellectually to fraternal twins, but a definite conclusion is not warranted by the research.

It is important to note that twins generally are handicapped when compared with a normal population and this would be significant in their learning to read, since it suggests that they would not proceed at the same rate as singletons. From the research it would be expected that identical twins would perform at approximately the same level, whereas differences in performance would be more characteristic of fraternal twins.

## II. LANGUAGE DEVELOPMENT IN TWINS

The verbal environment of the early years is important to language development. Not only must children be exposed to a great deal of language with those who can supply a proper language model, but they must be given also many opportunities to communicate with others, particularly adults. In this way, they learn to associate words with their correct referents, to become familiar with multiple meanings of words, and in general, to express themselves in oral form.



Twins are unique in that they consist of a unit which does not lend itself to a situation requiring verbal communication with others to the degree that a single-born child in a family seeks and maintains such contact. Moreover, the close relationship existing between a pair of twins encourages them to communicate with each other, and for this purpose they do not always rely on accepted forms of communication. For these reasons it is assumed that twins would show retardation in the acquisition of language. And in fact, research tends to support this assumption.

#### Pre-School Language Development

For purposes of comparing the language development of twins with that of single-born children Day investigated 80 pairs of twins, 20 pairs at each of four age levels from two to five years.<sup>36</sup> By repeating the techniques employed by McCarthy and by using her sample as a basis for comparison, Day was able to compare the development of language in twins with that of singletons of the same sex, age, and socio-economic status.<sup>37</sup>

The methods of analyses covered four areas of language growth and included mean length of response, functional analysis, grammatical construction of a sentence, and word analysis by parts of speech.

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<sup>36</sup>Ella J. Day, "The Development of Language in Twins: I.A. Comparison of Twins and Single Children," Child Development, III (Sept., 1932), 178.

<sup>37</sup>McCarthy, loc. cit.



The analyses were applied to a language record obtained from each child. The record consisted of fifty consecutive oral responses made by the subject. Picture books and toys were used to stimulate speech.

Linguistic retardation in twins was evident in every method of analysis employed and this retardation increased with age for the age groups tested when comparisons were made with the singletons.

Some of the most notable findings resulting from this investigation are as follows: a comparison of the data covering mean length of response indicated that differences between the twins and the singletons increased with age and favoured the singletons. These differences were statistically significant. The mean length of response for three year old singletons was slightly above the five year old twins. The differences between the twins and singletons are illustrated in Figure 1.<sup>38</sup>

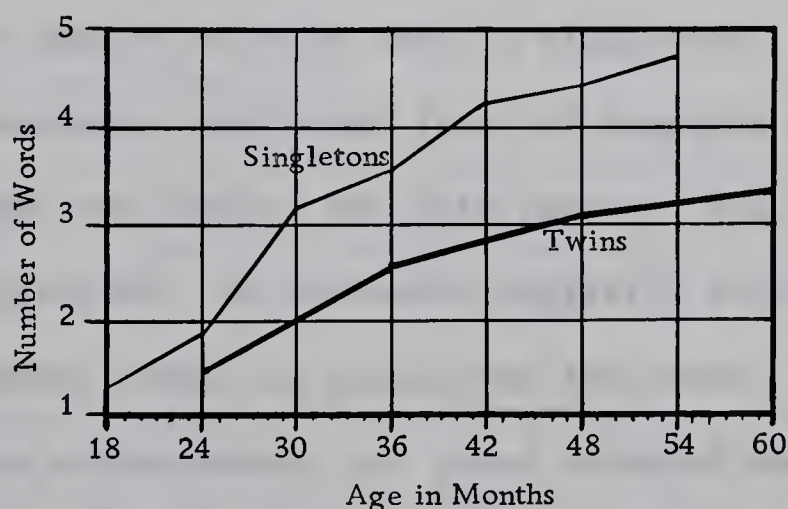


Figure 1. Mean Length of Response of Singletons and Twins by Chronological Age. (From Day, p. 185)

<sup>38</sup>Day, op. cit., p. 185



As can be seen from Figure 1, the most rapid gain in length of response is made between two and three years by both twins and singletons. Although twins gain only one word in the entire year, singletons gain more than one word in the first half of the year. This difference in rate of development remains relatively the same up to five years.

The functional analysis revealed that the twins showed lack of development in those areas which are subject to the greatest developmental changes with age, for example, naming, emotionally toned responses and questions. Of particular interest is that in ego-centric responses and dramatic imitation the twins were in advance of the singletons. Day suggested that this might have been due to the close relationship characteristic of twins.

The third phase of the analysis involving sentences, showed that functionally complete and structurally incomplete responses were present to a greater degree in twins than in singletons. There was an increase of simple sentences and other forms of complete sentences by the twins at the upper age levels, but this increase did not nearly parallel that of singletons. As sentence complexity increased, relative differences between twins and singletons increased.

The twins were approximately two years retarded when comparisons were made between the two groups in the mean number of total words used. Differences were apparent also in use of various parts of speech. At two years, the twins used a smaller percentage of verbs.



At all levels they used a smaller percentage of adjectives, pronouns, and conjunctions, and a greater percentage of interjections.

Twin girls were slightly superior to twin boys in language development, but the differences were not as great as those between boys and girls who were singletons.

Occupational class proved to be a source of differentiation. Twins from the upper occupational group were superior to twins from the lower occupational group. Furthermore, single-born children of the lower occupational class were superior to twins of the upper occupational class in mean length of response as well as in other specific phases of the analyses.<sup>39</sup>

Day's study not only revealed language retardation in twins but raised the question of whether or not this retardation continued after school entrance when more opportunities are presented to twins for wider social contacts.

#### Primary School Language Development

The question arising from Day's study concerning continued language retardation of twins after school entrance precipitated a study by Davis.

Davis examined 83 pairs of twins, 173 singletons and 97 only children at three levels, 5½ years, 6½ years, and 9½ years.

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<sup>39</sup>

Ibid., pp. 179-199.



The procedures for the collection and analysis of data were similar to those followed by McCarthy<sup>40</sup> and Day.<sup>41</sup> However, Davis included a detailed analysis of articulation in addition to the analyses used by these investigators.

From her study Davis concluded that retardation in language is apparent in twins from 5½ to 9½ years of age, but is less marked as the twins approach 9½ years. Deficiencies in articulation were more pronounced than deficiencies in language content. Only children were superior to singletons and twins. However, singletons with siblings were superior to twins.<sup>42</sup>

Thus, it would seem that although language deficiency in twins is apparent even after beginning school, increased socialization tends to offset this deficiency to some extent.

An interesting study has been reported by Luria and Yudovich and although it concerns only one pair of twins, it lends support to findings by Davis. These investigators observed a pair of identical twin boys of five years of age. The twins were retarded in all areas of language development and this retardation was accompanied by more general difficulties in the process of abstraction, in play situations,

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<sup>40</sup>McCarthy, loc. cit.

<sup>41</sup>Day, loc. cit.

<sup>42</sup>Edith A. Davis, The Development of Linguistic Skills in Twins, Singletons with Siblings, and Only Children from Age Five to Ten Years (Minneapolis, University of Minnesota Press, 1937) p. 165.



in carrying out precise instruction, and above all in classifying. At the beginning of kindergarten training an effort was made to eliminate the twin situation to some extent by placing the boys in separate groups. The result was that the twins were forced to communicate with others and they gradually adopted normal language behaviour. Linguistic learning was accompanied by improvement in cognitive activity.<sup>43</sup>

### Summary

It is indicated from research that language development in twins appears to be inferior to language development in singletons, possibly because verbal communication by twins is not necessary for satisfaction of social needs and the relative self-sufficiency of twins as a social unit reduces the need for adult contact.

While it seems apparent that language deficiency in twins seems to decrease after they start school, an important implication is obvious, namely, that twins begin their school experiences with a handicap which would influence their ability, at least in the initial stages, to maintain academic achievement at a level comparable to singletons. The importance of language facility is stressed by Anastasi, in a discussion of the retarding effect of "twin environment" upon growth in this area. She states:

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<sup>43</sup> Alexandr R. Luria and F. Yudovich, Speech and the Development of Mental Processes in the Child, J. Simon (ed.) (London: Staples Press, 1959), p. 126.



Linguistic retardation...has far-reaching implications for all intellectual development. Not only is language necessary as a means of communication in most human learning, but linguistic symbols themselves play an important part in problem solving and in the more abstract and complex intellectual functions.<sup>44</sup>

### III. SCHOOL ACHIEVEMENT OF TWINS

Large scale investigations regarding academic achievements of twins have been carried out in Sweden and represent the first attempts to collect and analyse data indicative of their performance and to make comparisons with a population of singletons.

In his survey of Swedish inductees, Husen compared the average marks in the twin population with those obtained by the control population of singletons. This comparison revealed that differences were evident which were highly significant and which favoured the singletons. Further observations showed that the twins had a higher frequency of marks below pass standard. The highest frequency of marks below pass standard occurred for writing and the lowest for reading.<sup>45</sup>

Another investigation reported by Husen in 1963 involved 1090 twins, of whom 557 were boys and 533 were girls. The twins were in grade four and approximately eleven years of age when they completed

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<sup>44</sup>Anastasi, op. cit., p. 293.

<sup>45</sup>Torsten Husen, Psychological Twin Research: A Methodological Study (Stockholm: Almqvist and Wilsell, 1954), pp. 56-69.



the achievement test batteries which provided data for the analysis. They were compared with a random sample of 370 single-born children. In Table I are shown the comparisons resulting from the performance of the twins and the control group in three subject areas as measured by the achievement test battery.

In Reading, Writing and Arithmetic the single-born children obtained better scores. The differences between the scores were statistically significant.

Comparisons were made between the two groups on weighted standard scores in all three tests. Frequency curves revealed that the lower means among twins were due to a lower frequency of high scores in the twin population as well as to a higher frequency of low scores.<sup>46</sup>

#### Intra-pair Similarities

Close resemblance between identical pairs was maintained by the twins in school marks. For the inductees, the intra-class correlations averaged .77 for the identical twins and .52 for the fraternal twins. In reading, the intra-class correlations were, on the average .72 for the identical twins and .57 for the fraternal twins.<sup>47</sup>

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<sup>46</sup>Torsten Husen, "Intra-pair Similarities in the School Achievement of Twins," The Scandinavian Journal of Psychology, IV (June, 1963), 108-114.

<sup>47</sup>\_\_\_\_\_, Psychological Twin Research: A Methodological Study, (Stockholm: Almqvist and Wiksell, 1959), p. 66.



COMPARISON BETWEEN THE ENTIRE FOURTH GRADE AGE GROUP OF TWINS  
AND A SAMPLE OF SINGLE-BORNS ON WEIGHTED SUMS OF STANDARD SCORES  
IN THE SUBJECT MATTER AREAS COVERED BY THE TEST BATTERY.  
(FROM HUSEN, P. 111)<sup>48</sup>

	M	S.D.	M diff	S diff	C.R.	P <
Reading Tests						
Boys:						
Single-borns	32.99	7.54	2.83	0.49	5.73	.001
Twins	30.16	7.01				
Girls:						
Single-borns	32.21	6.57	2.16	0.45	4.75	.001
Twins	30.05	6.11				
Writing Tests						
Boys:						
Single-borns	50.56	11.07	3.15	0.76	4.13	.001
Twins	47.41	9.90				
Girls:						
Single-borns	53.83	9.92	3.54	0.65	5.40	.001
Twins	50.29	9.20				
Arithmetic Tests						
Boys:						
Single-borns	40.89	8.87	1.42	0.60	2.37	.02
Twins	39.47	9.09				
Girls:						
Single-borns	39.71	8.77	2.25	0.60	3.78	.001
Twins	37.46	8.38				

<sup>48</sup>Torsten Huson, "Intra-pair Similarities in the School Achievement of Twins," The Scandinavian Journal of Psychology, IV (June, 1963) 111.



In order to examine intra-pair similarities for the eleven year old twins intra-class correlations were computed also. Correlations for total scores on Reading, Writing, and Arithmetic ranged from .738 to .831 for identical twins and from .401 to .692 for fraternal twins, and emphasized the close similarity of identical twins.<sup>49</sup>

### Summary

Husen's findings regarding the scholastic achievement of twins have far-reaching implications in that learning difficulties seem to be characteristic of twins and they are not generally thought of as a group of exceptional children.

Identical twins appear to be more similar in school achievement than fraternal twins. The extent to which similarities are real is difficult to ascertain. Identical twins often look alike and behave in the same manner and it is reasonable to suppose that teachers would tend to confuse them when marking tests and assessing over-all achievement. Also, there would possibly be a tendency on the part of some teachers to fall prey to the "halo-effect" when scoring tests of identical twins especially, which were not wholly objective in format.

### IV. LEFT-HANDEDNESS IN TWINS

It is an interesting observation that left-handedness is

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<sup>49</sup>

Ibid., p. 112.



thought to be more common among twins than among singletons. As a result, several investigations have considered this phenomenon.

A precise statement of the effect of dominance anomalies on progress in learning to read cannot be made. However, mixed dominance appears to be one of the representative variables characteristic of reading disability in young children.<sup>50</sup> The possible relationship between lateral dominance and twinning and between lateral dominance and reading disability suggests the necessity of including research relating to handedness in twins in this review.

The following studies are typical of those investigating incidence of left-handedness in twins. Generally, the research in this area is based on two questions: Is left-handedness present in twins to a greater extent than it is in the general population? Is left-handedness more typical of identical twins as opposed to fraternal twins?

#### Amount of Left-Handedness in Twins

Lauterbach was the first investigator to attempt to determine the amount of left-handedness in twins. The subjects consisted of 201 pairs of twins from grades three to twelve. A questioning technique was used to determine handedness. Demonstrations, such as ball

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<sup>50</sup>Albert J. Harris, How to Increase Reading Ability (New York: David McKay Co., Inc., 1961), p. 254.



throwing, were required as supplementary devices, but the report of the investigation does not clarify the basis of selection for these demonstrations.

The findings revealed that 38 pairs, or 18.90 percent of the twin pairs contained at least one member who was left-handed. Lauterbach did not make comparisons with a group of singletons and therefore could not make a positive statement regarding the amount of left-handedness in the twins in his sample as it related to a normal population. However, he was of the opinion that the percentage he obtained represented an unusually high incidence.<sup>51</sup>

Handedness data were obtained also by Wilson and Jones for 386 twins, of whom 70 pairs were identical and 123 pairs were fraternal. Similar data were collected from a control population of 521 singletons. The mean ages for these groups were 15.20 for the identical twins, 15.20 for the fraternal twins, and 15.18 for the singletons. The criteria used to determine handedness in this study consisted of asking the subjects two questions, namely, "Which hand do you write with?" and "Which hand do you throw a ball with?"<sup>52</sup> If hesitancy on the part of a subject was evident in replying to the latter question, he was required to demonstrate.

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<sup>51</sup>Lauterbach, op. cit., pp. 531-542.

<sup>52</sup>Paul T. Wilson and Harold E. Jones, "Left-Handedness in Twins," Genetics, XVII (Sept., 1932), 564.



Based on the criterion of throwing hand, Wilson and Jones found a higher incidence of left-handedness in the twins (10.7 - 12.0 per cent) than in the singletons (6.5 per cent). For the writing hand the twins showed an unreliably higher percentage than the controls (5.5 versus 4.1 per cent). The excess of left-handedness in the twins did not result from pairs of twins being left-handed, but from one member of a pair being affected. Between 18.6 and 20.4 per cent of the twin pairs contained one left-handed member whereas only 1.6 per cent of the pairs contained two left-handed members.<sup>53</sup>

In this investigation the criteria for determining handedness were very general and no attempt was made to identify cases of conversion. The dichotomous classification of subjects as either right-handed or left-handed did not take into account the fact that there are degrees of preference. Ambidextrous subjects were included with the left-handed group. As a consequence of these weaknesses, the findings from this particular study must be viewed with caution.

In an attempt to improve on previous diagnostic procedures, Newman, Freeman, and Holzinger administered motor tests of "wrist-tapping" and "finger-tapping" to fifty pairs of identical twins and fifty pairs of fraternal twins. It was felt that these tests would more accurately discriminate hand preferences since performance

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<sup>53</sup>Ibid., pp. 560-571.



would not be influenced by prior training. The subjects were assigned scores which ranged along a five point scale designating degrees of handedness. Placement on the scale was in terms of strong right, weak right, strong left, weak left, or ambidextrous. Final diagnosis of handedness was determined by combining the scores obtained from these tests with statements by the parents of the subjects, as well as the subjects themselves regarding hand preference. Except for relatively few minor discrepancies there was agreement between these criteria.

Twenty-one per cent of the twin pairs contained one member who was left-handed. Another 10 per cent of the pairs included ambidextrous individuals, where one twin of the pair, and sometimes both exhibited this tendency.<sup>54</sup>

In the above mentioned study, comparison was not made with a control population, but the percentages of incidence of left-handedness was high and in line with previous investigations.

Similarly, Shields found a high incidence of left-handedness among twins. In his investigation the subjects were asked to complete an adaptation of Blau's Questionnaire for Preferred Laterality. On the basis of the results obtained from the questionnaire, Shields, stated that 22 per cent of the twins were left-handed.<sup>55</sup>

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<sup>54</sup>Newman, Freeman, and Holzinger, op. cit., pp. 42-49.

<sup>55</sup>Shields, op. cit., p. 41.



The results obtained by Husen indicated that the frequency of left-handedness for the twin population was significantly higher at 6.2 per cent than for the control population of singletons where the corresponding figure was 4.8 per cent. The investigator felt that the difference was not due to a higher frequency of left-handedness among twins than among singletons, but rather to different techniques in obtaining information about this trait. In the case of the singletons, they were asked to respond in writing as to whether or not they were left-handed, while the twins were presented with the question in oral form and responded orally. Husen felt that the former technique may not have been as effective in identifying those who were left-handed. He concluded therefore, that left-handedness in a twin population paralleled that of a population of singletons.<sup>56</sup>

#### Intra-group Comparisons

Lauterbach found that left-handedness occurred in 11.44 per cent of the like-sex pairs and 7.46 per cent of the unlike-sex pairs. Since a number of twins in the like-sex group were possibly fraternal pairs it would seem that it is characteristic of not only identical pairs but also fraternal pairs to exhibit a high incidence of left-handedness. However, Lauterbach's percentages may not have been as meaningful as he maintained. His criteria for diagnosing handedness

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<sup>56</sup>Torsten Husen, Psychological Twin Research: A Methodological Study, (Stockholm: Almqvist and Wiksell, 1959), pp. 84-86.



lacked thoroughness. Moreover, he classified his subjects as either right or left without taking into account degrees of handedness.<sup>57</sup>

Classification of twin pairs into identical twins and fraternal twins was undertaken by Wilson and Jones. Based on the criteria of writing and ball throwing, there were no significant differences between the two types.<sup>58</sup>

Analysis of the data compiled by Newman, Freeman and Holzinger revealed that the frequency of left-handedness among the identical twins was nearly twice as high as among the fraternal twins. Forty per cent of the identical pairs as contrasted with 22 per cent of the fraternal pairs showed left-handedness in one or both individuals constituting the pairs.<sup>59</sup>

Recent studies have not confirmed findings that more identical than fraternal twins tend to left-handedness. In the Swedish survey the frequency of left-handedness was the same for both groups. In the identical twin group 6.7 per cent stated that they were left-handed as compared with 6.2 per cent in the fraternal group. This evidence is particularly significant in view of the fact that this study is the first where frequency of left-handedness was determined with a representative twin population.<sup>60</sup> Shields also found that there was no

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<sup>57</sup>Lauterbach, op. cit., p. 535.      <sup>60</sup>Husen, op. cit., pp. 86-87.

<sup>58</sup>Wilson and Jones, op. cit., pp. 566-567.

<sup>59</sup>Newman, Freeman, and Holzinger, op. cit. pp. 42-49



statistically significant difference between twin types in hand preference.<sup>61</sup>

### Summary

The controversy surrounding left-handedness in twins has been evident in research for many years. However, the evidence from research does not justify making conclusive statements as to the incidence of left-handedness in twins. Early studies indicated that left-handedness was fairly common among twins but basic weaknesses, for example, inadequate diagnostic measures and subsequent questionable classification, limited the findings of these investigations. Recently, one of the largest twin studies ever undertaken negated the findings of previous studies.<sup>62</sup> However, more large scale investigations are necessary before definitive conclusions can be drawn.

The assumption that left-handedness is more frequent in identical than fraternal twins has not been borne out in research. In general, incidence of left-handedness is the same for both groups.

### OVERVIEW OF THE RESEARCH

This chapter has presented a review of studies relating to

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<sup>61</sup>Shields, op. cit., p. 41.

<sup>62</sup>Husen, op. cit., pp. 83-88.



twin development. The lack of investigations relating to twins as an atypical group has necessitated the reporting of research which utilized the twin method in the assessment of certain traits for the purpose of applying findings and conclusions to a population of singletons. Nevertheless, a review of these investigations has produced notable findings and observations regarding twins which has helped provide a background for this study.

An examination of the data pertaining to intellectual development suggests that twins as a group are inferior to singletons. The usual explanation given for this is that twins are subject to pre-natal and natal hazards and on the basis of evidence provided by research birth trauma is more prevalent among twins than among singletons. Whether or not this accounts adequately for retarded mental development in twins is open to question. It is possible that other factors are operating about which there is no information at the present time. Whatever the underlying causes, it would appear that mental handicaps are inherent in twinship. Thus an important educational implication arises, namely, that twins generally will not be able to perform at an academic level commensurate with their single-born peers. Although there are only a limited number of studies which investigate the scholastic achievement of twins, the findings suggest that they do achieve lower grades in school, and it has been demonstrated that reading is one of the areas where difficulty is encountered.



Intelligence is not the sole criterion for reading readiness or achievement. This has been illustrated by the fact that a high intelligence does not guarantee success in reading. However, it is significant that children with low I.Q.'s experience difficulties which hinder normal progress, particularly if their limitations have not been provided for by especially adapted programs.

Language is an intellectual acquisition. Therefore, it is not unusual that one of the characteristics of slow-learners is linguistic incompetency. Reading is essentially a language experience and deficiencies in language would be reflected in reading. That twins are retarded in language development has been verified in the research. In the case of twins, inadequate mastery of language may be due partly to intellectual retardation, but undoubtedly, their social milieu is an important factor also. Since linguistic deficiency in twins is most severe prior to and at school entrance, it is indicated that reading progress may be limited at a crucial stage, that is, at the beginning of the process.

Lateral difficulties may or may not be a characteristic feature of twins. Research does not justify drawing a decisive conclusion. But if twins are prone to dominance problems it may be that they would have difficulty in developing directional skills. This should tend to compound any problems they might have in learning to read.

Identical twin pairs appear to resemble each other more



closely than fraternal twin pairs. Thus, it may be assumed that identical pairs would show greater similarity of achievement in reading than fraternal pairs.

In view of the fact that findings from research point to the existence of factors which could restrict the reading progress of twins it is important to examine their performance in this area in order to ascertain if their achievement is below the expected level of their single-born classmates. It is equally important, if difficulties are apparent, to analyse patterns of performance so that specific weaknesses may be identified.



## CHAPTER III

### THE PLAN OF THE STUDY

This chapter is divided into four sections. The first section gives a description of the sample. The second selection discusses the grade one reading program for the Province of Alberta. In the third section the purposes and descriptions of the tests used in the study, as well as the method of test administration are presented. The fourth section discusses the treatment of the data.

#### I. DESCRIPTION OF THE SAMPLE

##### Selection

The twins selected for this investigation were from the two largest school systems in the City of Edmonton. An effort was made to contact all twins who were in grade one during the 1963-1964 school year. Twin pairs were identified by careful examination of the lists containing the names of all children enrolled in grade one for the 1963-1964 school year.

From the number initially selected, several twin pairs were eliminated for various reasons. For example, it was necessary to exclude three pairs who were repeating grade one, since the investigation was limited to twins who were exposed to one year of formal reading instruction. Four pairs were eliminated because the schools they attended were not contacted as they were engaged in other research at the time of this investigation. Parents of three pairs were unwilling for their children to take part in the survey. Other



eliminations resulted from a serious visual handicap of one of a pair and the recent demise of one of a pair.

In all, 14 pairs of twins were included in the sample. Of the fourteen pairs, 6 pairs were identical twins and 8 pairs were fraternal twins. Table II shows the distribution of twin pairs according to the two twin types, identical and fraternal. The identical and fraternal types are further classified according to sex.

TABLE II

## DISTRIBUTION OF TWIN PAIRS ACCORDING TO TYPE AND SEX

Twin Type	Sex	Number of Pairs
Identical	Girls	3
	Boys	3
Fraternal	Girls	1
	Boys	2
	Boy-Girl	5

Determination of Zygosity

Twin classification according to type was based primarily on information provided by the parents. In addition to parents' confirmation of zygosity, the examiner observed the twins for similarities and differences. This procedure involved observation of eye colour, hair colour, texture and whorl, skin texture and tone, and shape of the features, for example, nose, ears, teeth and hands.



Correspondence between the examiner's and the parents' classification was evident in all cases.

### Age and Intelligence

At the time of testing the mean chronological age of the twins was 81 months. The range extended from 75 to 96 months.

Scores from the Detroit Beginning First Grade Intelligence Test were obtained for all the twins. On the basis of these scores the mean intelligence quotient for the group was 113 with a standard deviation of 15.83. A comparison with city norms revealed that the twins' scores placed them within the 50th percentile. Thus, the twins performed at a level commensurate with average grade one students.

Differences in age and intelligence between the identical twin group and the fraternal twin group were slight.

### Additional Data

The twins were from approximately the same cultural background. Each twin had at least one other sibling in addition to his co-twin. None of the twins suffered from physical or sensory handicaps. General health was adequate. With the exception of one pair who tended to miss considerable time from school, absenteeism was not characteristic of the group. School records revealed that the twins showed considerable variation in academic achievement.



## II. GRADE ONE READING PROGRAM

The Program of Studies for Elementary Schools of Alberta suggests five types of instruction for reading development. These are: basic reading, extension reading, recreational reading, reading in the content subjects, and corrective reading.<sup>1</sup> In practice, the basic reading program is emphasized. The authorized readers for the Province of Alberta are: New Curriculum Foundation Series, Ginn Basic Readers, and Reading for Meaning Series.<sup>2</sup> Generally, all three series agree as to what skills should be taught, but there are minor differences as to time of presentation.

Ideally, grade one children are expected to complete the readiness books, the preprimers, the primers, and the first reader of the chosen series by the end of the year. At this time, grade one pupils have been introduced to visual and auditory perception skills, comprehension skills, and oral reading skills.

## III. TESTS USED IN THE STUDY

Auditory, visual, and laterality screening tests were administered for the purpose of appraising present status and locating possible deficiencies. The objectives of the grade one reading

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<sup>1</sup>Department of Education, Program of Studies for Elementary Schools of Alberta (Edmonton, Alberta, 1965), pp. 5-6.

<sup>2</sup>Ibid., pp. 7-8.



program provided the basis for the selection of the reading tests used in the investigation. Tests were chosen which would assess those aspects of reading ability which had received emphasis during the school year. In addition to determining a general measure of reading achievement, it was considered necessary to diagnose areas of specific strengths and weaknesses so that a complete picture of the twins' proficiency in a variety of abilities essential to reading progress could be obtained.

The following tests were used in this study:

Auditory Screening Test - Maico Audiometer

Visual Screening Test - Ortho-Rater

Harris Tests of Lateral Dominance (Second Edition)

Wepman Auditory Discrimination Test, Form 1

Dolch Basic Sight Word List of 220 Service Words

Schonell Graded Reading Vocabulary Test

Gray Oral Reading Test, Form A (Revised Edition, 1963)

Durrell Analysis of Reading Difficulty (New Edition)

California Achievement Tests - Reading, Lower Primary

Form W (1957 Edition)

Gates Primary Reading Tests, Type PWR, PSR, PPR,  
(Revised Edition, 1958)

The purpose and description of each test is as follows:

#### Auditory Screening

Good auditory acuity does not necessarily insure success in



reading, but a hearing disorder may be a contributing factor which will aggravate an existing reading difficulty.<sup>3</sup> Therefore, the twins were given an audiometric examination for the purpose of determining hearing efficiency.

The Maico Audiometer was used to investigate hearing acuity. This instrument is an electronic device which by means of headphones transmits pure tones of known intensity. Decibel levels range from minimum to maximum loudness, and frequencies range from 125 to 8000 cycles. A record of each child's performance on this test was made on a prepared audiogram which provides for data concerning hearing acuity for left and right ears.

### Visual Screening

Visual deficiencies have always been recognized as handicaps to reading proficiency, but there is disagreement as to how much defectiveness constitutes a handicap. In summarizing the research pertinent to this area, Smith and Dechant state:

In searching for possible relationships between visual defects and reading achievement, we must consider the likelihood of multiple causation. In many cases an eye defect alone might not reduce reading efficiency, yet the same defect combined with other factors might do so. And it is quite possible that certain eye defects affect reading performance only when their severity is beyond certain critical points.<sup>4</sup>

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<sup>3</sup>Henry P. Smith and Emerald V. Dechant, Psychology in Teaching Reading (Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1961) p. 140.

<sup>4</sup>Ibid., p. 132.



Eames stresses individual differences in the effects of visual impairment and maintains that while one child may be seriously handicapped with a visual anomaly and as a consequence experience difficulty in learning to read, another child experiencing the same handicap will learn to read in spite of it.<sup>5</sup>

While visual efficiency may not always result in poor reading, good vision will insure comfortable reading. However, visual inefficiency cannot be overlooked as a possible factor which may impede reading progress, particularly in combination with other inhibiting factors. For this reason, the twins were given a visual screening test.

Visual efficiency was measured by the Ortho-Rater. This is an instrument which contains slides and is designed to evaluate visual performance. The twelve slides representing twelve tests measure four aspects of visual efficiency. These are: vertical and lateral phoria, or muscle balance, at near and far points, visual acuity, or fineness of visual discrimination, at near and far points, for right and left eye, and for both eyes, depth perception at far point, and colour discrimination at far point.

Data are recorded on prepared record forms.

The Bausch and Lomb Optical Company, developer of the

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<sup>5</sup> Thomas H. Eames, "Visual Handicaps to Reading," Boston University Journal of Education CXLI (1959), 4.



Ortho-Rater state that the tests have high reliability and validity and provide norms based on large scale testing.<sup>6</sup>

#### Harris Tests of Lateral Dominance

Despite the proliferation of studies there is no conclusive evidence that mixed dominance is a contributing factor to reading disability. However, the fact that mixed dominance appears to be characteristic of reading disability groups has been stressed by Harris.<sup>7</sup> Thus, the determination of laterality status by more than casual observation is important in the assessment of reading development.

The Harris Tests of Lateral Dominance were administered to the twins to determine laterality status. These tests include activities designed to provide information regarding hand, eye, and hand-eye preference.

Scores for each of the tests are expressed in terms of ratings arranged along a five-point continuum and reflect degrees of preference. Lateral dominance is determined from the composite ratings assigned to each of the areas tested. The final single rating for each area also ranges along the same five-point continuum and is

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<sup>6</sup>Bausch and Lomb Optical Company, (Reference Manual) Master Ortho-Rater and Modified Ortho-Rater (Rochester, New York), p. 45.

<sup>7</sup>Albert J. Harris, How to Increase Reading Ability (New York: David McKay Co., Inc.), 1961, p. 254.



expressed as either Strongly Right, Moderately Right, Mixed, Moderately Left, or Strongly Left.

Reliability and validity data are given for the tests. Norms are provided.

The specific value of the Harris Tests of Lateral Dominance is pointed out by Tinker in a review in the Fourth Mental Measurements Yearbook. He states:

These various tests for measuring lateral dominance are well chosen. The view that a composite score derived from responses in several tests is more valid than the score on a single one is sound.<sup>8</sup>

#### Wepman Auditory Discrimination Test

It is not uncommon that children who have normal auditory acuity experience difficulty in discriminating between sounds and in ability to remember sounds. Since auditory discrimination is necessary to phonetic analysis deficiency in this skill would hinder reading progress, particularly if auditory methods are stressed in the word analysis program. The importance of accurate auditory discrimination has been stressed by Smith and Dechant:

The child must be able to distinguish sounds so that he can learn to speak correctly and to associate the appropriate sound with the printed symbol. The ability to discriminate between the various phonetic elements of a word is a skill essential in reading.<sup>9</sup>

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<sup>8</sup>Miles A. Tinker, "Harris Tests of Lateral Dominance," The Fourth Mental Measurements Yearbook, Oscar K. Buros (ed.), (New Jersey: The Gryphon Press, 1953), 644.

<sup>9</sup>Smith and Dechant, op. cit., p. 135.



The Wepman Auditory Discrimination Test, Form 1 was administered to the twins in order to assess their ability to distinguish the fine differences which exist between various phonemes characteristic of English speech. The test is made up of 40 pairs of words. Each pair of words was matched for familiarity by choosing words close together on the Lorge-Thorndike list. They were matched for length also. Ten pairs of words are similar. The remaining 30 pairs differ by a single phoneme but the phonemes occur within the same phonetic category. Each pair of words is pronounced and the pupil responds by saying whether the words are the same or different. Responses are recorded and the number of errors tabulated. Pairs of words which are the same are scored in the Y column, pairs of words which are different are scored in the X column. Responses scored in the X column are used to assess auditory discrimination. Responses scored in the Y column are used to judge the validity of the test.

The Wepman Auditory Discrimination Test is standardized and norms are provided for various age levels.

In a review in the Sixth Mental Measurements Yearbook, DiCarlo highly recommends the Wepman Auditory Discrimination Test as an accurate test of auditory discrimination particularly since the "specificity of the task eliminates contamination of performance by auditory memory span."<sup>10</sup>

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<sup>10</sup>Louis M. DiCarlo, "Auditory Discrimination Test," The Sixth Mental Measurements Yearbook, Oscar K. Buros (ed.), (New Jersey: The Gryphon Press, 1965), 940.



### Dolch Basic Sight Word Test of 220 Service Words

In the initial stages of learning to read a child learns to recognize a number of words which are presented as wholes and in a meaningful setting. These words are called sight words and are basic to reading progress. Gray maintains that:

For at least two reasons much of the child's early success in reading depends on his mastery of an initial stock of sight words: ability to identify these sight words enables him to read his pre-primers and primer fluently; he will also use his ever-growing stock of sight words as a basis for understanding the relation between letters and sounds (phonetic analysis) and the function of root words, inflectional endings, pre-fixes and suffixes (structural analysis). These understandings will enable him to attach sound to meaning to many unfamiliar printed words while reading.<sup>11</sup>

It is, therefore, an important aspect in evaluating reading performance to ascertain to what extent a child has developed a basic sight vocabulary. The Dolch Basic Sight Word List of 220 Service Words was used to determine the twins' status in this area. The test consists of 220 words which are common to all printed material and which must be recognized by sight to insure efficient reading. The list includes those words whose function in a sentence is not tied to specific subject matter. In this book, Teaching Primary Reading, Dolch states:

This list may well be called 'basic' because it includes the 'service words' that are used in all

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<sup>11</sup>William S. Gray, On Their Own in Reading (Chicago: Scott, Foresman and Co., 1960), pp. 17-18.



writing, no matter on what subject. Conjunctions join clauses regardless of what the clauses are about; prepositions introduce phrases of every kind; pronouns stand for any and all persons and things; adverbs modify every kind of verb. Verbs denote action or being of every sort of subject, and the auxiliaries, practically all of which are included in this list, are used with all the verbs of the language.<sup>12</sup>

The Dolch Basic Sight Word List of 220 Service Words was compiled following comparison of three word lists. These lists were: the list published by the Child Study Committee of the International Kindergarten Union, the Gates List, and the Wheeler-Howell list. The 220 words selected for the Dolch list were common to all three of these lists. An examination of reading, arithmetic, history and geography texts, used by elementary school children indicated that the words were used extensively, particularly at the primary level.<sup>13</sup>

Scores for the test are in terms of the number of words recognized correctly. Norms are not available for the test.

#### Schonell Graded Reading Vocabulary Test

Use of sight words must be supported by other word recognition techniques in order that a child may develop independence in reading. The importance of developing skills to aid in word attack is stressed by Bond and Tinker:

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<sup>12</sup>Edward W. Dolch, Teaching Primary Reading (Champaign, Illinois: Garrard Press, 1952), p. 268.

<sup>13</sup>\_\_\_\_\_, Problems in Reading (Champaign, Illinois: Garrard Press, 1948), pp. 97-107.



Skill in word recognition is a fundamental part of the equipment of a capable reader at any level. As a child matures in reading, the materials and methods used in teaching him gradually demand more and more independent word recognition. The child who has failed to establish effective means of identifying and recognizing words for his level of advancement, will be handicapped in all other aspects of reading.<sup>14</sup>

A major aid in word recognition is word analysis and techniques to develop this skill are an integral part of the reading program at the primary level. Assessment of ability to recognize words which are presented out of context and which ordinarily require familiarity with principles of structural and phonetic analysis was obtained through the administration of Schonell Graded Reading Vocabulary Test.

The test consists of one hundred words of increasing difficulty. The words are arranged in 10 levels of 10 words each. Performance is evaluated in terms of a Reading Age. In addition to obtaining an indication of a subject's word recognition power the test is a valuable instrument in diagnosing specific word recognition difficulties. The test has been standardized in Great Britain.<sup>15</sup>

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<sup>14</sup>Guy L. Bond and Miles A. Tinker, Reading Difficulties: Their Diagnosis and Correction (New York: Appleton-Century Crofts, Inc.,) 1957, p. 261.

<sup>15</sup>Fred J. Schonell and F. Eleanor Schonell, Diagnostic and Attainment Testing (Edinburgh, Great Britain: Oliver and Boyd Ltd., 1960), pp. 38-42.



Gray Oral Reading Test (Revised, 1963)

For a number of years oral reading had little value in actual classroom practice, mainly because purposes and procedures were not based on sound learning principles. Today, the major emphasis is on silent reading, but oral reading plays an important part in the total reading program and its role has changed considerably so that inherent weaknesses are minimized and intelligent use of oral reading is accentuated.

The value of oral reading in the classroom is discussed by Heilman. Among the advantages to be derived from this practice he stresses the importance of oral reading as a means of teaching reading skills and providing an opportunity for discovering weaknesses in reading skills.<sup>16</sup> Oral reading tests which stress process as well as product are immensely valuable in observing oral reading and word recognition skills.

In order to evaluate oral reading growth and to assess any existing difficulties in this area of reading the Gray Oral Reading Test, (Revised, 1963) was given to the twins. Specifically, the test was administered for the purpose of obtaining information regarding accuracy of word recognition when context was involved, comprehension of material read orally, phrasing and expression.

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<sup>16</sup>Arthur W. Heilman, Principles and Practices of Teaching Remedial Reading (Columbus, Ohio: Charles E. Merrill Books, Inc., 1961), pp. 146-148.



The test consists of thirteen passages of graded difficulty. The first three passages are designed for grade one, the next five for grades two to six, while the remaining passages are for higher grade levels.

The general format of the passages is designed to coincide with that used in texts appropriate for various grade levels. Increased passage difficulty is based on vocabulary, word and sentence length, and sentence complexity.

A total passage score is obtained by recording the number of errors and the time (in seconds) for each passage. Tables are provided in the manual so that total passage scores can be used to determine grade equivalents. Tentative norms are available for boys and girls separately.

A record of the types of errors is made for diagnostic purposes. Four questions follow each passage, and are concerned with the literal meaning of the passage, thus facilitating objective scoring. A grade equivalent is not available for these scores, but the results are useful for diagnosis.

Data concerning the reliability and validity are presented in the accompanying manual.

### Durrell Analysis of Reading Difficulty

A number of tests comprise the Durrell Analysis of Reading Difficulty. The tests range from those suitable for non-readers to a grade six level and evaluate a number of important reading skills.



The oral reading, silent reading, and listening sub-tests were administered for the purpose of evaluating certain basic abilities necessary for comprehension of meaning, namely, recall of factual material, following directions, and making inferences. Since the paragraphs provided in the tests are of equal difficulty, comparison could be made among the various media to test comprehension. The silent reading and oral reading paragraphs also provided a basis for assessing speed of reading.

Oral Reading. This section of the battery consists of eight paragraphs. The first paragraph is designed for grade one and considered a basal paragraph. Subsequent paragraphs are read until an upper level is established in terms of number of errors or time limit. Questions involving the literal meaning follow each paragraph. Thus, this test provided material for assessment of oral reading in addition to that provided by the Gray Oral Reading Test.

Silent Reading. Eight paragraphs graded in difficulty comprise this test. The time required to read each selection is recorded. At the conclusion of each paragraph the pupil is asked to recall all that he can remember of the passage. A record is made of the number of facts recalled.

Listening. This test consists of seven passages, one for each grade level from one to seven. The examiner reads a paragraph to the pupil following which questions are asked concerning the literal meaning. Listening comprehension is estimated as being at the grade



level where not more than one question is missed.

Letters (Naming Letters, Identifying Letters Named, Matching Letters). Knowledge of the names of the letters of the alphabet shows a high relation to achievement in reading.<sup>17</sup> The sub-test Letters was administered for the purpose of ascertaining the twins' letter knowledge at various levels. In the first section of this test the letters of the alphabet are presented in capital and lower case and the child is asked to name them. In Identifying Letters Named the child is asked to point to the letters named by the examiner. In the final section of the test, Matching Letters, the letters are presented separately in a tachistoscope and the child must match the presented letter with an identical letter in the test booklet. Use of the tachistoscope requires the child to perceive the symbol and retain it in his memory in order to make proper identification.

Visual Memory of Words. The importance of visual memory is stressed by Gray who states that this skill is an integral part of word perception.<sup>18</sup> The Visual Memory of Words sub-test was administered to evaluate development of this skill.

In this test letter symbols and words are presented in the

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<sup>17</sup>Emerald V. Dechant, Improving the Teaching of Reading (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1964), p. 158.

<sup>18</sup>William S. Gray, op. cit. p. 16.



tachistoscope. The child is required to perceive the symbol, retain it in memory, and to draw a circle around the corresponding symbol in the test booklet. Norms are available for this test.

Hearing Sounds in Words. This test also assesses proficiency in skill necessary to word perception, namely, the ability to distinguish separate sounds in spoken words.

The pupil is required to underline the words in the test booklet which begin, end, or begin and end like the one spoken by the examiner. In addition to discriminating sounds, the test requires the pupil to remember the sound and relate it to its visual symbol. Comparison of the results of this test was made with the Wepman Auditory Discrimination Test.

Norms are provided for the Hearing Sounds in Words sub-test.

California Achievement Test - Lower Primary, Form W.

This test was administered for the purpose of obtaining grade scores relating to reading achievement and as a further aid in diagnosing areas of strengths and weaknesses.

The test is divided into two parts, Reading Vocabulary and Reading Comprehension.

The Reading Vocabulary test consists of four sections: Word Form, Word Recognition, Meaning of Opposites, and Picture Association. The four sections contain a total of sixty items designed to measure achievement and diagnose specific difficulties related to reading vocabulary.



The Reading Comprehension test has five items which test a pupil's ability to follow directions. Ten additional items are related to stories which are read by the pupil. These items check ability to comprehend and interpret the stories. The results of this test were compared with the results of the Durrell Analysis of Reading Difficulty sub-test, Silent Reading.

A test of Letter Recognition is included in the California Achievement test and was administered since it involved matching unlike forms of the same letter and this type of matching was not required in the Durrell Analysis of Reading Difficulty sub-test, Letters.

For the vocabulary and comprehension tests, reliability and validity data are presented in the accompanying manual. Norms are available. The 1957 edition of the test was used. This test has been standardized in the United States and renormed in 1963. Interpretation of raw scores is in terms of grade placement.

#### Gates Primary Reading Tests, Type, PWR, PSR, PPR

These tests were administered at the end of grade one by the classroom teachers in the city schools. The twins' scores on the tests were obtained by the investigator so that comparison with city norms could be made.

Three separate tests make up the test battery.

Type 1: Word Recognition. This test measures a pupil's ability to identify common primary words and consists of 48 items, each of which



includes a picture and 4 words. The pupil must identify and encircle the word that tells most about the picture.

Type 11: Sentence Reading. This test measures the ability to read and understand sentences made up of common primary words. The test consists of 45 sentences and comprehension is measured by ability to identify and mark pictures which illustrate the meaning of the sentences.

Type 111: Paragraph Reading. This test consists of 26 exercises including one or more sentences accompanied by drawings. The test measures ability to read thought units with understanding by requiring the pupil to execute accurately the directions in each exercise.

The manual provides reliability and validity information. Norms are available. Extended descriptions of norms, reliability data and standardization procedures are presented in a later addition to the manual.

#### Method of Administration

All tests were administered by the writer and another graduate student with identical background in administering and scoring tests.

The tests were administered during the months of May and June, 1964. From three to four hours were required to test each subject. Usually the tests were administered in two sessions. In cases where it was felt that fatigue would influence the results unduly, a third



session was required to complete the testing. The tests were given at the school attended by the twins and at the Reading and Language Centre at the University of Alberta.

All tests were hand-scored by the writer.

#### IV. TREATMENT OF THE DATA

The results of the reading tests are presented in terms of raw scores and grade levels. Since the results of the auditory and visual screening tests are interpreted as either pass or fail percentages were calculated to show the proportion of individuals and pairs who passed or failed the test. Scores for the lateral screening tests are expressed as ratings which reflect degrees of preference. Therefore, calculation of the percentage of individuals and pairs who obtained various ratings enabled the specific identification of the proportion who exhibited different characteristics relating to preference. The fact that the number of twins in both groups was unequal further necessitated the use of percentages in order to make meaningful comparisons between identical and fraternal twins. Percentages were calculated also to show the proportion of various types of errors for identical and fraternal twins as this allowed for a realistic assessment of relative deficiencies characteristic of the twin types and facilitated comparison between them.

Since the sample used in this investigation was not a random sample and was limited to a small number, non-parametric statistics



were used to test the significance of the differences between scores.

Mean scores for the twins and a population of singletons were calculated so that comparisons could be made. The scores obtained by the twins were compared with the percentile ranks established by city norms.

Intra-group comparisons involved calculation of mean scores so that differences could be observed. White's Rank Test for the Significance of the Difference Between Two Groups was applied to the scores obtained by the identical twin group and the fraternal twin group. This test was chosen because it is non-parametric and is particularly adaptable when the two groups consist of unequal numbers. The significance of the difference between the scores obtained by the two groups was tested by calculation of  $T$  and  $T^1$  according to Edwards.<sup>19</sup> Significance was established at the accepted one per cent and five per cent levels.

Intra-pair comparisons involved calculation of the sums of the differences and the means of the differences. To test the significance of the differences between pairs the Randomization Test for Matched Pairs was used.<sup>20</sup> This test was chosen because

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<sup>19</sup> Allen L. Edwards, Statistical Methods for the Behavioural Sciences (New York: Holt, Rinehart and Winston, 1962), pp. 417-419.

<sup>20</sup> Sidney Siegel, Nonparametric Statistics for the Behavioural Sciences (New York: McGraw Hill Book Co., Inc., 1956), pp. 88-92.



it is appropriate for two small related samples and since it uses all of the information in the sample it is a powerful non-parametric technique. Significance was established at the accepted one per cent and five per cent levels.



## CHAPTER IV

### FINDINGS OF THE STUDY

The purpose of this chapter is to present the results of the testing program.

The chapter is divided into four sections. The first section compares the reading achievement of the twins with a grade one population for the City of Edmonton. The second section compares the performance of the identical twins with the fraternal twins. In the third section, intra-pair scores are examined and compared in order to ascertain whether similarity of performance is more typical of identical twins than of fraternal twins. A summary of the findings is presented in the fourth section.

The comparisons between the two twin types and between twin pairs involved the following areas; auditory acuity, visual efficiency, lateral dominance, perceptual development, word recognition, oral reading, comprehension, and speed of reading.

In order to make intra-group comparisons, tests of significance were applied to the scores obtained by the identical twins and the fraternal twins. Differences between the scores were tested for significance by calculation of  $T$  and  $T^1$  according to Edwards.<sup>1</sup> Tests of significance were applied to intra-pair scores as well. For this

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<sup>1</sup>Allen L. Edwards, Statistical Methods for the Behavioural Sciences (New York: Holt, Rinehart and Winston, 1962), pp. 417-419.



purpose the Randomization Test for Matched Pairs was used.<sup>2</sup>

# 1. COMPARISON OF THE TWINS WITH A GRADE ONE POPULATION

The reading achievement of the twins was compared with that of a normal grade one population in order to discover whether differences existed between the two groups.

The scores obtained by the twins on the Gates Primary Reading Test were compared with the scores of grade one students in the City of Edmonton.<sup>3</sup> Table III presents the data relating to this test.

TABLE III

## SUMMARY OF THE RESULTS OF THE GATES PRIMARY READING TESTS

Mean Difference			
Twins (N=28)	2.7	0	N.S.
Grade One Pupils (N=1,989)	2.7		

<sup>2</sup>Sidney Siegel, Nonparametric Statistics for the Behavioural Sciences (New York: McGraw Hill Book Co., Inc., 1956), pp. 88-92.

<sup>3</sup>Edmonton Separate School Board, Elementary Division, 1964.



As can be seen from Table III the mean grade score for the twins and the mean grade score for the grade one students were the same. Thus, there was no significant difference between the two groups. It can be stated, therefore, that the performance of the twins was typical of the performance of grade one pupils generally.

Variation in the performance of the twins was noted when the scores of the twins were compared with the percentile ratings for the grade one students. Table IV shows the percentile ratings for the twins.

TABLE IV

SUMMARY OF THE PERCENTILE RATINGS FOR THE  
TWINS FOR THE GATES PRIMARY READING TEST

Percentile	10	25	50	75	90
Number	2	7	10	5	4

Table IV illustrates that a number of twins achieved scores which placed them above or below the fiftieth percentile range. Ten individuals scored within the fiftieth percentile range and nine scored above and nine scored below this range.

## II. COMPARISON OF THE PERFORMANCE OF THE IDENTICAL TWIN GROUP WITH THE FRATERNAL TWIN GROUP

Comparisons between the two twin types were undertaken to



discover whether one type was superior to the other in test performance.

### Screening Tests

The results of the audiometric test revealed that hearing deficiencies were prevalent in both groups. Table V presents the data relating to the auditory screening test. The percentages shown in the table are based on the number of individuals in each group. The twins who indicated a loss of hearing acuity of 20 or more decibels at one or more frequencies were classified as failures on the test.

As can be seen from Table V, 41.7 per cent of the identical twins passed the test and 58.3 per cent failed the test. Fifty per cent of the fraternal twins passed the test and 50 per cent failed. Differences between the percentages obtained by the two groups were slight. The large percentage of failures in the two groups suggests a high incidence of hearing deficiency among identical and fraternal twins.

The incidence of hearing loss in the general population is not known but it has been estimated that from 5 to 10 per cent of school children have hearing deficiencies.<sup>4</sup> Adams found that 15 per cent of

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<sup>4</sup>Henry P. Smith and Emerald V. Dechant, Psychology in Teaching Reading (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961) pp. 136-137.



TABLE V

SUMMARY OF COMPARISONS GIVEN IN PERCENTAGES FOR THE AUDITORY  
AND VISUAL SCREENING TESTS FOR THE TWO GROUPS

	Identical N=12	Fraternal N=16
AUDITORY		
Passed	41.7%	50.0%
Failed	58.3	50.0
VISUAL		
Passed	91.7	87.5
Failed	8.3	12.5



555 reading disability cases examined at the St. Louis Reading Clinics indicated a loss of 20 or more decibels.<sup>5</sup> Thus, from the evidence available, it is apparent that the hearing loss experienced by the twins is unusually high.

The difference between the identical twins and the fraternal twins in visual status was slight. Table V indicates that 91.7 per cent of the identical twins and 87.5 of the fraternal twins passed the visual screening test. The percentages for the twins who failed the test represented one identical twin and two fraternal twins. In all three cases the degree of deficiency was mild.

Mixed dominance was characteristic of both twin types. Table VI summarizes the data relating to laterality preference. From Table VI it can be seen that 33.3 per cent of the identical twins and 25 per cent of the fraternal twins demonstrated right hand preference. Nearly twice as many fraternal twins as identical twins showed a moderately right hand preference as represented by the percentages of 31.3 for the fraternal twins and 16.7 for the identical twins. Fifty per cent of the identical twins and 37.5 per cent of the fraternal twins indicated mixed hand preference. None of the identical twins showed a left hand preference, whereas 6.3 per cent of the fraternal twins showed a slight tendency to do so. Thus, the per-

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<sup>5</sup>Mary Louise Adams, "The Saint Louis Public Schools Reading Clinics: A Follow-Up Study," (unpublished Ph.D. thesis, Saint Louis University, Saint Louis, Missouri, 1960), p. 85.



TABLE VI

SUMMARY OF COMPARISONS GIVEN IN PERCENTAGES FOR THE LATERAL  
DOMINANCE SCREENING TESTS FOR THE TWO GROUPS

	Identical N=12	Fraternal N=16
<b>HAND DOMINANCE</b>		
Right	33.3%	25.0%
Moderately right	16.7	31.3
Mixed	50.0	37.5
Moderately left	0.0	6.3
<b>EYE DOMINANCE</b>		
Right	58.3	68.8
Moderately right	8.3	0.0
Mixed	8.3	0.0
Left	25.0	31.3
<b>HAND-EYE DOMINANCE</b>		
Right-Right	25.0	18.8
Right-Left	8.3	6.3
Moderately right-right	8.3	18.8
Moderately right-left	8.3	12.5
Mixed-right	25.0	31.3
Mixed-moderately right	8.3	0.0
Mixed-mixed	8.3	0.0
Mixed-left	8.3	6.3
Moderately left-left	0.0	6.3



centage of twins in both groups who indicated mixed or left preference tended to be high. Although more identical than fraternal twins indicated this trait, the differences between the two groups were slight. Harris reported that 32.8 per cent of unselected seven year old school children showed a tendency to mixed or left handed preference.<sup>6</sup> In view of this the number of twins who indicated mixed or left hand preference was high.

More variation was observed in identical than in fraternal twins in eye preference. As Table VI shows the identical twins demonstrated right, moderately right, mixed and left eye preference, while the preference of the fraternal twins was limited to either right or left. Fifty-eight per cent of the identical twin group indicated right eye dominance and 68.8 per cent of the fraternal twins showed this preference also. Eight per cent of the identical twins showed a moderately right preference and the same percentage indicated mixed preference. Twenty-five per cent of the identical twins and 31.3 per cent of the fraternal twins showed left preference. Thus, the number of individuals in the identical twin group who showed mixed or left preference and the number of fraternal twins who showed left preference represented a fairly large number from both groups. As was noted in handedness, more identical than fraternal twins showed mixed or left preference, but the difference between the groups was slight.

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<sup>6</sup>Albert J. Harris, How to Increase Reading Ability (New York: David McKay Co., Inc., 1951), p. 253.



Combinations of handedness and eyedness resulted in many different patterns. Table VI illustrates that the most common patterns in the identical group were: Hand--right, eye--right, and hand--mixed, eye--right. Twenty-five per cent of the identical twins indicated right hand, right eye preference and 25 per cent indicated mixed hand preference and right eye preference. These same two patterns were discernible in a large number of fraternal twins. Nearly nineteen per cent showed a right hand, right eye preference and 31.3 per cent showed a mixed hand, right eye preference. In addition, 18.8 per cent of this group showed a moderately right hand, right eye preference. Although a relatively small percentage of twins in both groups demonstrated a right hand, right eye preference, this finding is consistent with a previous finding by Harris for approximately the same age group.<sup>7</sup>

### Perceptual Skills

There were no statistically significant differences between the two groups on the auditory and visual perception tests. Table VII summarizes the results of the tests. Mean scores are in terms of raw scores.

The norms provided for the Wepman Auditory Discrimination test indicate that inadequate development is shown by six year old

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<sup>7</sup>Ibid., p. 253.



TABLE VII

SUMMARY OF COMPARISONS FOR THE WEPMAN AUDITORY DISCRIMINATION TEST  
AND THE DURRELL ANALYSIS OF READING DIFFICULTY SUB-TESTS HEARING  
SOUNDS IN WORDS AND VISUAL MEMORY FOR WORDS FOR THE TWO TWIN TYPES

Test	Possible Score	Mean Score Identical N=12	Mean Score Fraternal N=16	T	T <sup>1</sup>	
Wepman Auditory Discrimination	30	23.5	23.5	163.5	184.5	N.S.
Hearing Sounds In Words	29	20.0	22.0	194.5	153.5	N.S.
Visual Memory	20	11.5	13.6	167.0	181.0	N.S.



children when more than five errors are made in attempting to identify differing phonetic elements. Table VII shows that the mean scores for both twin types are the same and are below the level which would suggest satisfactory development. According to the norms provided for the Hearing Sounds in Words sub-test both groups indicated adequate development. This is interesting in view of the performance on the Wepman Auditory Discrimination test. A possible explanation may be that the Wepman Auditory Discrimination test required the children to recognize differences between phonetic elements which is a more difficult task than identifying similarities, which was required for the Hearing Sounds in Words sub-test.

From Table VII it can be seen also that the fraternal twins were slightly superior to the identical twins on the Hearing Sounds in Words sub-test, as evidenced by a mean score of 20 for the identical twins and a mean score of 22 for the fraternal twins. On this test the fraternal twins made proportionately fewer errors in all categories tested, namely, beginning consonants, consonant digraphs and blends, final consonants, and beginning and final consonants. For both groups on the two tests the fewest errors occurred with beginning consonants and the greatest number of errors occurred when consonant digraphs and blends were involved.

Generally, the twins experienced difficulty in the visual perception and retention of word forms and many errors characterized the performance of both groups.



Table VII shows that the identical twins obtained a mean score of 11.5 and the fraternal twins obtained a mean score of 13.6. The difference between the two groups favoured the fraternal twins. However, the difference between the performance of the two groups was not statistically significant.

Since the norms provided for this test are not local norms a definitive statement cannot be made regarding the performance of either group. However, the available norms suggest that both twin types are deficient in visual discrimination. The twenty words comprising the test are graded in difficulty. The identical twins made proportionately more errors on the first ten words than the fraternal twins. Errors on the last half of the test were more evenly distributed between both groups. Both the identical and fraternal twins tended to rely on the general configuration of words and failed to perceive significant details.

The results of the tests of letter knowledge indicated that both groups generally had an adequate knowledge of letters. However, there were exceptions and differences were noted between the groups. Table VIII summarizes the data pertaining to these tests.

The mean score of 41 for the identical twins and the mean score of 50 for the fraternal twins indicated that the fraternal twins were more skilled in naming letters than the identical twins. The difference between the performances of the two groups was statistically significant at the 5 per cent level.



TABLE VIII

SUMMARY OF COMPARISONS FOR THE DURRELL ANALYSIS OF READING DIFFICULTY  
 SUB-TEST LETTERS AND THE CALIFORNIA ACHIEVEMENT SUB-TEST  
 MATCHING LETTERS (MIXED FORMS) FOR THE TWO TWIN TYPES

	Possible Score	Mean Score Identical N=12	Mean Score Fraternal N=16	T	T <sup>1</sup>	
Naming Letters	52	41	50	223.5	124.5*	S.
Identifying Letters Named	52	50	51	184.0	164.0	N.S.
Matching Letters	52	51	51	171.0	177.0	N.S.
Matching Letters (Mixed Forms)	12	10	11	246.0	102.0**	S.

\* Significant at the 5 per cent level

\*\* Significant at the 1 per cent level



Identifying letters named by the examiner did not pose a problem for either group. The slight superiority of the fraternal twins was evident. However, the difference between the performance of the two groups was not statistically significant. Matching letters shown by the examiner suggested adequate development and the mean score of 51 was the same for both groups. When mixed forms were involved in matching letters, the mean score of 11 for the fraternal group and the mean score of 10 for the identical group illustrated the superiority of the former group. The difference between the performances of the groups was statistically significant at the 1 per cent level.

#### Word Recognition

The results of the sight word test indicated differences between the two groups which favoured the fraternal twins. However, the differences between the scores were not statistically significant. Table IX presents the comparative data relating to the test results.

Table IX shows the superiority of the fraternal twins, but the difference between the performances of the groups was not significant. Also, the fraternal twins had fewer errors and fewer words not attempted than the identical twins but the differences were not statistically significant.

It was interesting to note that the greatest number of errors in both groups was caused by eleven words: went, wash, try, come, write, with, thank, cut, ran, cold, and sit.



TABLE IX

SUMMARY OF COMPARISONS FOR THE DOLCH BASIC SIGHT VOCABULARY  
OF 220 SERVICE WORDS FOR THE TWO TWIN TYPES

	Mean Score Identical N=12	Mean Score Fraternal N=16	T	T <sup>1</sup>	
Number of Words Correct	138	156	199.0	149.0	N.S.
Number of Errors	24	16	141.5	206.5	N.S.
Number of Words Not Attempted	58	48	146.5	201.5	N.S.

Austin, Bush, and Huebner state that 25 per cent of the words on the Dolch list should be recognized by the end of grade one by children who are making normal progress in reading.<sup>8</sup> Thus, a score of 55 words correct would suggest adequate performance. All twins with the exception of one fraternal twin achieved a score higher than this. It may be concluded therefore that both groups have acquired ample sight vocabulary.

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<sup>8</sup>Mary C. Austin, Clifford L. Bush, and Mildred H. Huebner, Reading Evaluation: Appraisal Techniques for School or Classroom (New York: The Ronald Press Co., 1961), p. 12.



The Schonell Graded Reading Vocabulary test and the California Achievement sub-test Vocabulary revealed weaknesses in word recognition. Table X presents the data for these two tests. The results of the Schonell Graded Reading Vocabulary test are in terms of reading ages. The results of the California Achievement sub-test Vocabulary are in terms of grade levels.

TABLE X

SUMMARY OF COMPARISONS FOR THE SCHONELL GRADED READING VOCABULARY TEST AND THE CALIFORNIA ACHIEVEMENT SUB-TEST VOCABULARY FOR THE TWO TWIN TYPES

	Identical N=12	Fraternal N=16	T	T <sup>1</sup>	
<u>Schonell Vocabulary</u>					
Mean Reading Age (in months)	74.5	80.0	208.5	139.5	N.S.
<u>California Vocabulary</u>					
Mean Grade Level	1.76	2.16	213.5	134.5	N.S.

Table X shows that the mean reading age for the identical twins was 74.5 months and the mean reading age for the fraternal twins was 80 months. The difference between the reading age of the two groups was not statistically significant. For the California sub-test the mean score of 2.16 for the fraternal twins suggests a higher level of performance than the mean score of 1.76 for the identical twins.



The difference between the performances of the two groups was not statistically significant.

On the Schonell Graded Reading Vocabulary test difficulty in applying phonetic and structural analysis to words read out of context was apparent and for this reason percentages were calculated to determine those areas where the greatest difficulty existed. Errors were classified according to twelve types. Types of errors and percentages based on the occurrence of these errors are shown in Table XI.

TABLE XI

TYPES OF ERRORS AND PERCENTAGES OF OCCURRENCE ON THE SCHONELL GRADED READING VOCABULARY TEST FOR THE TWO TWIN TYPES

Error Classification	Identical N=12	Fraternal N=16
Initial Consonants	5%	4%
Final Consonants	5	4
Consonant Digraphs	8	4
Consonant Blends	22	15
Consonant Additions	3	2
Medial Vowels	19	15
Roots	3	2
Word Endings	30	32
Silent Letters	0	7
Nonsense Words	3	7
Reversals	0	4
Total Error	3	4

Table XI indicates that for both twin groups the largest percentages of errors were observed in consonant blends, medial vowels,



and word endings. Typical of errors in consonant blends were: Fog for frog, cowd for crowd, and cook for clock. Typical errors in medial vowels included: sat for sit, puple for people, and flewer for flower. Difficulties in word endings resulted in words such as the following: play for playing, down for downstairs, and flower for flowers.

Many errors were typical of the performance of both groups on the California Achievement sub-test Vocabulary. Table XII gives the percentages of errors in each category tested.

TABLE XII

PERCENTAGE OF ERRORS FOR THE FOUR CATEGORIES OF THE CALIFORNIA  
ACHIEVEMENT SUB-TEST VOCABULARY

	Identical N=12	Fraternal N=16
Word Form	14%	20%
Word Recognition	24	17
Meaning of Opposites	55	38
Picture Association	40	26

It is indicated in Table XII that both groups made more errors in the Meaning of Opposites section of the test than in any other. The response to the Picture Association section resulted in a high percentage of error for both groups as well. The two sections of



the test which called for word recognition only, and did not involve word meaning resulted in lower percentages of error for both twin types.

### Oral Reading

The mean scores for the Gray Oral Reading Tests are in grade levels. Table XIII summarizes the data relating to this test.

TABLE XIII

SUMMARY OF COMPARISONS FOR THE GRAY ORAL READING TESTS  
FOR THE TWO TWIN TYPES

Mean Score Identical N=12	Mean Score Fraternal N=16	T	T <sup>1</sup>	
1.47	1.83	187.5	160.5	N.S.

Although the fraternal twins performed at a higher level, as suggested by the mean score of 1.83, the difference between the scores obtained by the two groups was not statistically significant. A wide range of scores characterized both groups, but was particularly notable among the fraternal twins. The range of scores for the identical twins was from 1.0 to 2.6 while the range of scores for the fraternal twins was 1.0 to 4.0. The scores obtained by the majority of twins were low and suggested difficulty in oral reading ability.



Omissions and substitutions constituted the largest number of errors for both groups. The fact that the children read rapidly may have accounted for this. It was noted during the administration of the tests that the twins rarely paused to use word analysis. Only four children of the entire group hesitated when they were unsure of certain words. The general tendency of the group was to keep reading and either omit an unknown word or substitute another one for it.

In many instances, substitutions did not greatly alter the meaning of the passage, e.g. day for morning, cat for kitten. Other substitutions were characterized by too much reliance on word form, e.g. farm for fair, turned for trained.

The identical twins had a higher percentage of words aided than did the fraternal twins. This was accounted for by the fact that in the identical group one pair would not continue to read unless they were helped with unknown words by the examiner. This was permitted after a ten second interval. Since the pair required considerable assistance this tended to raise the percentage for the entire group.

Gross mispronunciations were typical of both groups and it was interesting to note that the same words generally caused difficulty to both groups. Typical of errors in this category were: results for rescue, anuzzle for another, potes for pilot.

Partial mispronunciations were typical of both groups also, but were more frequent among the fraternal twins. Many of the errors in



this category were caused by transpositions of letters, e.g. saw for was, aminals for animals.

Insertion of words occurred among the two groups, particularly among the fraternal group. However, the insertions consisted mainly of supplying words which did not alter the meaning of the passages to any great extent, e.g. "said the little boy" for "said the boy" and "they began to make snowman" for "then began to make snowmen."

Repetitions were more frequent in the fraternal group but most of these errors were made by two members of the group only.

It was previously noted in the Schonell Graded Reading Vocabulary test that the twins lacked skill in applying word analysis to unfamiliar words, and consequently made no attempt to do so during oral reading. A substantial sight vocabulary undoubtedly enabled them to make use of contextual clues so that they were able to read for meaning to some extent. Since attention was focused on general meaning, phrasing and expression were adequate for most individuals, although there was a tendency to read very rapidly. Labourious word by word reading was noted in two identical and two fraternal twins only.

### Comprehension

The results of the oral reading, silent reading, and listening comprehension tests are presented in Table XIV. Mean scores of the Gray and Durrell Reading Comprehension sub-tests, the Durrell Silent Reading and Listening Comprehension sub-tests are in term of raw scores.



Mean scores for the California Silent Reading sub-test are in terms of grade levels.

Table XIV shows that for the Gray Oral Reading Tests the mean comprehension score for the fraternal twins was 8.9 which was higher than the mean comprehension score of 8.3 for the identical twins. The difference between the two groups was not statistically significant. For the Durrell Analysis of Reading Difficulty sub-test, Oral Reading the mean comprehension score of 8.4 for the fraternal twins indicated a higher level of performance than the mean comprehension score of 7.1 for the identical twins. Again the difference between the scores for the two groups was not statistically significant.

TABLE XIV

SUMMARY OF COMPARISONS FOR ORAL AND SILENT READING AND  
LISTENING COMPREHENSION FOR THE TWO TWIN TYPES

Test	Possible Score	Mean Score Identical N=12	Mean Score Fraternal N=16	T	T <sup>1</sup>
<u>Oral Reading</u>					
Gray	12	8.3	8.9	194.5	153.5 N.S.
Durrell	10	7.1	8.4	213.0	135.0 N.S.
<u>Silent Reading</u>					
California		1.88	2.17	213.0	135.0 N.S.
Durrell	15	4.3	6.8	208.5	139.5 N.S.
<u>Listening</u>					
Durrell	7	3.5	4.5	201.5	146.5 N.S.



Both oral reading tests involved the recall of factual information. It was interesting to note that the majority of individuals in both groups tended to state that they did not know answers to certain questions rather than give an incorrect response.

The results of the silent reading tests indicated that the fraternal twins maintained their superiority over the identical twins. As can be seen from Table XIV the mean grade score of 2.17 for the fraternal twins on the California Achievement sub-test, Silent Reading was higher than the mean grade score of 1.88 for the identical twins. The difference between the two groups however, was not statistically significant. The questions on this test were of three types: following directions, recalling facts, and making inferences. An examination of the responses revealed that making inferences caused the greatest difficulty to both groups. The fraternal group was able to answer correctly only 50 per cent of the questions relating to this skill and the identical twins were even less successful and answered correctly only 30 per cent of the questions.

The Durrell Analysis of Reading Difficulty sub-test Silent Reading required the twins to recall facts without the aid of questions. The fraternal twins were able to recall facts in this manner more successfully than the identical twins as evidenced by the mean scores of 6.8 for the fraternal group and 4.3 for the identical group. The difference between the scores of the two groups was not statistically significant.



According to the norms provided for the listening test, a score of six is necessary for the groups to score at a grade one level. Since the norms are not based on a local population they are valuable only in that a general comparison can be made. Table XIV shows the mean number of questions answered correctly by the groups out of a total of seven questions. Table XIV illustrates that the mean scores for both groups are below the expected level of 6. The slight superiority of the fraternal twins was not statistically significant. The questions relating to the test involved recall of stated facts. In most cases, it was noted that if the twins did not know the answers to the questions they tended not to answer at all. In the case of some individuals where responses were attempted they were not even remotely connected with the facts in the presented stories.

A comparison of the Durrell Analysis of Reading Difficulty subtests, Oral Reading, Silent Reading, and Listening revealed interesting findings. Table XV presents the data relating to this comparison.

TABLE XV

SUMMARY OF COMPARISONS IN PERCENTAGES FOR THE MEAN NUMBER OF QUESTIONS ANSWERED CORRECTLY ON THE DURRELL ANALYSIS OF READING DIFFICULTY SUBTESTS ORAL AND SILENT READING AND LISTENING FOR THE TWO TWIN TYPES

	Identical N=12	Fraternal N=16
Oral Reading	71.0%	84.0%
Silent Reading	28.7	45.3
Listening	50.0	64.3



Table XV illustrates that both groups were able to answer more questions correctly when oral reading of material was involved. The low percentages of 28.7 for the identical twins and 45.3 for the fraternal twins indicates unsatisfactory performance on the silent reading test. The fact that a questioning technique was not used may have been an important factor which reduced the percentages for the two groups. The percentages for the listening test are low but the performance of both groups was better than on the silent reading test.

### Speed of Reading

The fraternal twins read more quickly than the identical twins. This finding is interesting in view of the fact that the fraternal twins indicated more understanding of material read than the identical twins. Table XVI shows the mean scores in seconds for both groups on the oral and silent reading test.

TABLE XVI

SUMMARY OF COMPARISONS FOR SPEED OF READING ON THE DURRELL  
ANALYSIS OF READING DIFFICULTY SUB-TESTS ORAL AND SILENT  
READING FOR THE TWO TWIN TYPES

	Mean Score Identical N=12	Mean Score Fraternal N=16	T	T <sup>1</sup>	
Oral	97.9	75.0	143	205	N.S.
Silent	93.4	67.1	125*	223	S.

\* Significant at the 5 per cent level



The superiority of the fraternal twins is illustrated in Table XVI. The difference between the performance of the two groups on speed of oral reading was not statistically significant. However, the difference between the groups for speed of silent reading was significant at the 5 per cent level.

### III. INTRA-PAIR COMPARISONS

The tendency for members of a pair of identical twins to be more alike than members of a pair of fraternal pairs has been noted in research. The explanation given is that identical pairs are genetically similar and by virtue of their primary likeness share a common environmental experience and accordingly act alike. Conversely, fraternal pairs are not the same in their hereditary equipment and because of their primary unlikeness experience their environment differently and tend to act increasingly unlike.

Consequently, the intra-pair comparisons were of particular interest in the treatment of the test scores. Calculation of mean intra-pair differences and the application of tests of significance to determine whether the scores between pairs were equivalent were undertaken in order to examine within-pair performance.

#### Screening Tests

The results of the audiometric examination revealed an interesting pattern which was typical of pairs in both groups.



Table XVII shows the percentages of auditory deficiencies for both twin groups.

TABLE XVII

## PERCENTAGES OF AUDITORY DEFICIENCIES - 20 DECIBELS (OR MORE)

Twin Type	One Member of a Pair			Two Members of a Pair			Total
	Both Ears	Right Ear	Left Ear	Right Ear	Both Ears		
Identical (N=6 pairs)	67.0	0.0	17.0	8.0	8.0		100
Fraternal (N=8 pairs)	62.5	37.5	0.0	0.0	0.0		100

As can be seen from Table XVII all pairs in both groups contained members who indicated a hearing loss of twenty or more decibels. Loss of acuity was characteristic of one member of the pair in all cases, with the exception of one identical pair where both members were affected. In this instance, one member displayed a loss at several frequencies in both ears, while the other member displayed a less severe loss in the right ear only. Thus, marked differences in hearing acuity were demonstrated by all pairs in both groups and neither twin type indicated a closer correspondence than the other.

Generally, the analysis of the visual performance of the identical pairs and the fraternal pairs did not suggest any anomalies.



One member of an identical pair and one member each of two fraternal pairs deviated from normal in visual acuity, but showed only a mild degree of deficiency. Their partners exhibited normal visual acuity. Thus, the differences between the members of these three pairs were slight.

It can be concluded therefore, that for both groups intra-pair resemblance was close and it was not characteristic of one group to show a greater intra-pair resemblance than the other.

Table XVIII presents the data relating to lateral dominance for the twin pairs.

TABLE XVIII

SUMMARY OF PERCENTAGES OF PAIRS DEMONSTRATING  
IDENTICAL PREFERENCE ON THE HARRIS TESTS  
OF LATERAL DOMINANCE

	Hand	Eye	Hand-Eye
Identical (N=6 pairs)	100.0	50.0	50.0
Fraternal (N=8 pairs)	37.5	62.5	25.0

Handedness. All six pairs of identical twins demonstrated the same hand preference whereas only three pairs or 37.5 per cent of



fraternal twins indicated similar dominance. The remaining five pairs of fraternal twins differed in handedness. Thus, the identical pairs were more similar in regard to this trait than the fraternal pairs.

Eyedness. Fifty per cent of the identical pairs showed the same eye preference and 62.5 per cent of fraternal twins showed the same eye preference. The closer resemblance between fraternal twins is interesting in the light of the finding from the handedness test where the identical pairs showed a closer correspondence than the fraternal pairs.

Handedness-Eyedness. The pairs in both groups tended to differ when combinations of hand-eye preferences were considered. Only 50 per cent of the identical pairs and 25 per cent of the fraternal pairs showed the same patterns of preference. The remaining pairs contained members who indicated dissimilarity when hand-eye preferences were combined.

Thus, except for eye preference, the identical pairs showed closer similarity than the fraternal pairs.

### Perceptual Skills

The randomization test did not reveal any significant differences between the identical pairs or the fraternal pairs for the auditory and visual perception tests. The data relating to the intra-pair comparisons are presented in Table XIX. The sums of the differences and the means of the differences are in terms of raw scores.

It is evident from Table XIX that on the Wepman Auditory



Discrimination Test that the means of the differences are very similar. Thus, the correspondence between the identical pairs was practically the same as the correspondence between the fraternal pairs. Although the differences were not significant between members of either group on the Durrell sub-test, the amount of resemblance was greater for the identical pairs. This was accounted for by the fact that four fraternal pairs as contrasted with only one identical pair showed a difference of 4 to 11 raw scores.

TABLE XIX

INTRA-PAIR COMPARISONS FOR THE WEPMAN AUDITORY  
DISCRIMINATION TEST AND THE DURRELL ANALYSIS OF  
READING DIFFICULTY SUB-TESTS HEARING SOUNDS  
IN WORDS AND VISUAL MEMORY FOR WORDS

Twin Type	Test	Sum of the Difference	Mean of the Difference	
Identical	Wepman Auditory	17	7.8	N.S.
Fraternal	Wepman Auditory	-36	7.7	N.S.
Identical	Hearing Sounds in Words	4	3.0	N.S.
Fraternal	Hearing Sounds in Words	1	5.1	N.S.
Identical	Visual Memory	-2	3.3	N.S.
Fraternal	Visual Memory	12	2.7	N.S.

Performance on the visual discrimination test indicated close correspondence for pairs in both groups. Table XIX illustrates that the average difference of 2.7 raw scores for the fraternal twins



suggested greater similarity of performance. However, intra-pair differences for both groups were not significant.

There were no significant differences between the pairs in either group resulting from the scores obtained on the test of letter knowledge. The results are shown in Table XX. The sums of the differences and the means of the differences are in terms of raw scores.

TABLE XX  
INTRA-PAIR COMPARISONS FOR THE KNOWLEDGE  
OF LETTERS SUB-TEST

Twin Type	Sum of the Difference	Mean of the Difference	
Identical	-4	4.3	N.S.
Fraternal	-3	2.9	N.S.

Table XX indicates that the fraternal pairs tended to greater similarity than the identical pairs. This finding is consistent with the previous finding from the visual discrimination test, where the fraternal pairs also indicated greater resemblance.

#### Word Recognition

Both twin types indicated almost the same degree of similarity on the Dolch Sight List of 220 Service Words. Table XXI presents the relevant data. The sums of the differences and the means of the differences are in terms of raw scores.



TABLE XXI

## INTRA-PAIR COMPARISONS FOR THE DOLCH SIGHT LIST OF 220 SERVICE WORDS

Twin Type	Sum of the Difference	Mean of the Difference	
Identical	-117	26.3	N.S.
Fraternal	123	26.6	N.S.

As can be seen from Table XXI the mean of the difference of 26.3 for the identical twins and the mean of the difference of 26.6 for the fraternal twins shows that an almost similar amount of resemblance was typical of pairs in both groups, although the difference between the identical pairs was slightly less. The differences between the pairs in both groups were not statistically significant.

There were no significant differences between the pairs in the two groups on the Schonell Graded Reading Vocabulary test and on the California Achievement sub-test Vocabulary. Table XXII shows the intra-pair comparisons for these tests. The sums of the differences and the means of the differences for the Schonell Graded Reading Vocabulary test are in terms of reading age and for the California sub-test, the sums of the differences and the means of the differences are in terms of grade level.



TABLE XXII

INTRA-PAIR COMPARISONS FOR THE SCHONELL GRADED READING  
VOCABULARY TEST AND THE CALIFORNIA ACHIEVEMENT  
SUB-TEST VOCABULARY

Twin Type	Test	Sum of the Difference	Mean of the Difference	
Identical	Schonell	-1	3 (months)	N.S.
Fraternal	Schonell	18	6 (months)	N.S.
Identical	California	-4	2 (months)	N.S.
Fraternal	California	28	5 (months)	N.S.

Although the differences between pairs were not significant Table XXII shows that for the Schonell test the mean of the difference of 3 months for the identical twins suggests a greater similarity between pairs than the mean of the difference of 6 months for the fraternal twins. Similarly while the differences were not significant for the California test the mean of the difference of 2 months for the identical pairs indicates a greater degree of correspondence than the mean of the difference of 5 months for the fraternal twins. An examination of the distribution of the intra-pair differences confirmed the greater uniformity of the identical pairs. Differences for the identical pairs tended to be consistently small and ranged from 0 - 6 months. In contrast to this the range of differences between scores for the fraternal pairs extended from 1 - 15 months.



### Oral Reading

Intra-pair differences were smaller for the identical than for the fraternal pairs on the Gray Oral Reading Tests. Table XXIII shows the results of the intra-pair comparisons. Sums of the differences and means of the differences are in terms of grade levels.

TABLE XXIII

#### INTRA-PAIR COMPARISONS FOR THE GRAY ORAL READING TESTS

Twin Type	Sum of the Difference	Mean of the Difference	
Identical	.9	.35	N.S.
Fraternal	5.4	.80	S*

\* Significant at the 5 per cent level

The closer similarity of the identical pairs is evident from Table XXIII. The dissimilarity of the fraternal pairs was significant at the 5 per cent level of confidence. In general the range between the scores achieved by the fraternal twins was considerable, the most extreme being twenty-seven months.

### Comprehension

The randomization test did not reveal any significant differences between the pairs for the Oral and Silent Reading Comprehension sub-tests. However, the difference between the identical pairs for



the Listening Comprehension sub-test was significant at the 5 per cent level. Table XXIV summarizes the data relating to the two tests. For the Oral Reading tests, the Durrell Silent Reading test and the Listening test, the sums of the differences and the means of the differences are in terms of the number of questions answered correctly. For the California Silent Reading test the sums of the differences and the means of the differences are in terms of grade levels.

TABLE XXIV

INTRA-PAIR COMPARISONS FOR ORAL AND SILENT READING  
AND LISTENING COMPREHENSION

Twin Type	Test	Sum of the Difference	Mean of the Difference	
<u>Oral</u>				
Identical	Gray	-8	2.3	N.S.
Fraternal	Gray	-6	1.0	N.S.
<u>Durrell</u>				
Identical	Durrell	-6	2.3	N.S.
Fraternal	Durrell	-2	1.2	N.S.
<u>Silent</u>				
Identical	California	1.6	.33	N.S.
Fraternal	California	2.8	.48	N.S.
<u>Durrell</u>				
Identical	Durrell	-4	2.3	N.S.
Fraternal	Durrell	-1	4.9	N.S.
<u>Listening</u>				
Identical	Durrell	10	1.7	S*
Fraternal	Durrell	-7	1.0	N.S.

\* Significant at the 5 per cent level



Table XXIV illustrates the closer resemblance for the fraternal pairs on the Oral Reading tests as compared with the identical pairs. The greater similarity of the fraternal pairs was maintained on both tests. The identical pairs tended to greater similarity of performance on the Silent Reading tests.

For the Listening test the mean of the difference of 1.7 for the identical pairs was greater than the mean of the difference of 1.1 for the fraternal pairs and indicates the greater similarity of the fraternal pairs. The difference between the identical pairs was significant at the 5 per cent level.

#### Speed of Reading

There were no significant differences between the reading rates of the identical pairs or the fraternal pairs on the oral and silent reading tests. Table XXV shows the results of the analyses of the reading rates obtained on the two tests. Sums of the difference and means of the difference are expressed in seconds.

TABLE XXV  
INTRA-PAIR COMPARISONS FOR SPEED OF READING

Twin Type	Test	Sum of the Difference	Mean of the Difference	
Identical	Oral	-17	44	N.S.
Fraternal	Oral	-108	20	N.S.
Identical	Silent	-37	34	N.S.
Fraternal	Silent	-58	16	N.S.



Table XXV illustrates the closer resemblance between the fraternal pairs in speed of oral reading and in speed of silent reading. It is interesting to note that the degree of correspondence was greater for both identical pairs and fraternal pairs in speed of silent reading.

#### IV. SUMMARY OF THE FINDINGS

This chapter has presented the test results and made comparisons at three levels.

The results of the comparison at the first level revealed that the performance of the twins in reading achievement as measured by the Gates Primary Reading Tests was typical of the performance of a population of grade one pupils.

Intra-group comparisons indicated interesting patterns of performance. Both twin types showed hearing deficiencies. Visual performance was normal for both groups. Mixed dominance was characteristic of the identical twin group and the fraternal twin group. In general, differences on the reading tests showed that the fraternal twins performed at a higher level than did the identical twins. The differences which favoured the fraternal twins on the Naming Letters test, Matching Letters, Mixed Forms test and the Speed of Silent Reading test were statistically significant.

No consistent pattern of performance regarding correspondence between pairs was evident from the intra-pair comparisons.



Dissimilarity of performance for all pairs was indicated on the Auditory Screening test. One twin of every pair showed a hearing loss, with the exception of one pair of identical twins, where both members of the pair experienced a loss of acuity. Visual status was normal for the pairs in both groups. The identical twins showed a greater similarity in hand preference whereas the fraternal twins showed a closer degree of correspondence in eye preference. The identical pairs also showed greater resemblance when eye, hand preferences were combined.

Of the remaining tests the identical pairs showed closer correspondence on the Hearing Sounds in Words sub-test, the Dolch Sight Word Test of 220 Service Words, the Schonell Graded Reading Vocabulary test, the California Achievement sub-test Vocabulary, the Gray Oral Reading Tests, and the Silent Reading Comprehension sub-tests of the Durrell Analysis of Reading Difficulty and the California Achievement test.

The fraternal pairs indicated greater resemblance on the Wepman Auditory Discrimination test, the Visual Memory for Words sub-test, Knowledge of Letters sub-test, the Oral Reading Comprehension sub-tests of the Durrell Analysis of Reading Difficulty and the Gray Oral Reading Tests, the Durrell Analysis of Reading Difficulty sub-tests, Listening and Speed of Reading.

Differences between the identical pairs on the Listening Comprehension tests and differences between the fraternal pairs on the Gray Oral Reading Tests were statistically significant at the five per cent level.



## CHAPTER V

### CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

The present study was undertaken in order to examine the reading achievement of twins in grade one so that patterns of performance might be identified. To accomplish this purpose, fourteen pairs of twins were selected from grade one classrooms in the City of Edmonton. Tests were administered which would reveal the presence or absence of fundamental reading skills. In addition, certain physical aspects of development relating to reading achievement were assessed. The analysis of the data involved computation of percentages, mean scores, the sums of the differences, and the means of the differences. Differences between scores were tested for significance. The findings were presented by making comparisons at three levels: between the twins and a population of single-born grade one children, between the identical and fraternal twins, and between twin pairs.

Conclusions based on the findings of the investigation, as well as implications and suggestions for further research are discussed in this chapter.

#### I. CONCLUSIONS

1. There is no significant difference between the twins in this study and a grade one population for the City of Edmonton in reading achievement.



Comparison of the performance of the twins with a grade one population revealed that there was no significant difference between the two groups. The mean score for the twins placed them within the fiftieth percentile range. It may be concluded therefore, that the performance of the twins was typical of grade one students generally. This conclusion is not consistent with that of Husen who found that single-born children obtained a significantly higher average score on reading tests than a representative group of twins.<sup>1</sup>

Comparison of the twins with a single-born population in this study was based on the Gates Primary Reading Tests. Since this test is a survey test it is designed to give a general measure of reading achievement. Thus, despite the fact that the twins indicated average performance on the Gates Primary Reading Tests, the results of the tests administered for the purpose of evaluating discrete abilities necessary for reading progress showed that deficiencies were present. Poor auditory and visual discrimination were evident. For example, the twins were unable to distinguish differences between various sounds or to perceive visually, significant details in words. It was not unexpected therefore, that word analysis skills showed inadequate development. However, despite limitations in the application of phonetic and structural analysis, the twins were able to read for

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<sup>1</sup>Torsten Husen, "Intra-pair Similarities in the School Achievement of Twins," Scandinavian Journal of Psychology, IV (June, 1963), 111.



meaning, at least to some extent. The finding that the greatest number of errors in oral reading involved omissions and substitutions of words which did not significantly change the meaning of the passages suggests that an adequate sight vocabulary and the utilization of contextual clues may have precluded the need for word analysis at this level and enabled the twins to read for general meaning. It was noted during the administration of the tests that many twins were unable to read at a grade two level and it was apparent that the context was too difficult and weakness in word analysis could no longer be concealed. As previously mentioned, comprehension of material written at the grade one level was fairly adequate, with the exception of listening comprehension where difficulties were observed. Of particular interest was the finding that a questioning technique was necessary for the recall of information and without this aid recall was extremely limited. In most instances comprehension was limited to recall of stated facts. The ability to make inferences was not developed.

2. There are no significant differences between identical twins and fraternal twins in perceptual skills, word recognition skills, oral reading skills, comprehension skills, and reading rate.

From a comparison of the test results for both groups the conclusion was reached that generally the performances of both twin types were equivalent. Nevertheless, differences between the two twin types were apparent. Two sub-sections of the letter perception test, Naming Letters and Matching Letters, Mixed Forms revealed statistically



significant differences which favoured the fraternal twins. Similarly, a significant difference which favoured the fraternal twins was observed for speed of silent reading. For the remaining tests, although the differences were not significant, the slight superiority of the fraternal group was evident. Thus, the pattern of performance indicated a consistent trend for the fraternal twins to perform at a higher level than the identical twins. This conclusion is in agreement with that of Husen who found a difference between the two twin types with regard to reading scores. The difference was almost negligible, but favoured the fraternal twins.<sup>2</sup>

Speculation as to why the differences existed between the groups suggests that various factors may have caused the discrepancy. For example, it is possible that selective factors may have contributed to the difference. Other factors which may have entered into the difference are mental and physical characteristics and socio-economic background.

3. There are no significant differences between identical pairs and between fraternal pairs in perceptual skills, word recognition skills, oral reading skills, comprehension skills, and reading rate.

All pairs tended to similarity of performance and there was no

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<sup>2</sup> Torsten Husen, Psychological Twin Research: A Methodological Study (Stockholm: Almqvist and Wiksell, 1959), p. 62.



definite trend for pairs of one twin type to show a greater degree of correspondence than the other. This conclusion differs from that of Husen who found that comparison of the different twin categories with reference to intra-class correlations in total scores for three subject matter areas, including reading, resulted in coefficients which ranged from .738 to .831 for the identical twins and from .401 to .692 for the fraternal twins.<sup>3</sup> The greater similarity of the identical twins as contrasted with fraternal twins has been observed generally in research. That the present study provided no evidence to support this may be attributable to several causes. Since the sample was limited to fourteen pairs of twins the similarity in performance may have been due to selection. Another consideration which could have an important bearing on the results is that the majority of the pairs shared the same classroom and were instructed by the same teacher. As a consequence, it would not be unlikely that certain elements relating to reading instruction assimilated by the partners could have been the same. Moreover, it would not be unreasonable to assume that teachers would expect twins to perform at the same level. This expectation could limit the level of performance of the more capable twin. Despite the fact that intelligence is only

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<sup>3</sup>Torsten Husen, "Intra-Pair Similarities in the School Achievement of Twins," Scandinavian Journal of Psychology, IV (June, 1963), 112.



one of the several factors related to reading proficiency, it is significant that it was observed in this study that where fairly large differences existed between members of pairs in intelligence quotients, only minimal differences were noted in reading scores. The close resemblance between pairs could be due also to an attitude about twins which is reflected not only in family and friends but in the twins themselves, namely, that twins should be alike. Thus, it could be argued that twins would wish to be alike and are satisfied if school achievement is parallel.

#### Additional Conclusions

Hearing deficiency was observed in both twin groups. Examination of the twins' audiograms revealed that a loss of 20 decibels was apparent in 58.3 per cent of the identical twins and 50 per cent of the fraternal twins. Within-pair comparison suggested a definite pattern in that the loss was characteristic of one member of every pair, except in the case of an identical pair where both members suffered a loss. The fact that the twins in this study indicated an unusually high incidence of hearing loss and the fact that one member of a pair was affected is extremely interesting. However, the conclusions that hearing deficiency was characteristic of the twins and that the deficiency tended to affect one member of the pair are justified only within the range of this investigation. A review of twin research did not reveal any information relating to hearing deficiency in twins. However, the conclusions drawn from the findings of this



study suggest possible biological problems of great interest. For example, are there prenatal or natal factors operating in multiple births which would produce a loss of hearing acuity in one of the members? Is there a relationship between birth order and hearing loss?

The findings resulting from visual efficiency tests revealed that except for a mild degree of deficiency in acuity for three individuals visual deficiencies were not apparent. The conclusion was reached that visual efficiency was normal and intra-pair resemblance was close.

Mixed or left dominance was observed in both identical and fraternal twins and there was a slight tendency for the identical twins to exhibit this trait to a greater extent than fraternal twins. Shields<sup>4</sup> found a high incidence of left-handedness among twins but Husen<sup>5</sup> did not. Neither Wilson and Jones<sup>6</sup> nor Shields<sup>7</sup> found a higher incidence among identical twins. The conclusion was reached also that identical twin pairs indicated the same hand preference. It was

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<sup>4</sup>James Shields, Monozygotic Twins: Brought Up Apart and Brought Up Together (London: Oxford University Press, 1962), p. 41.

<sup>5</sup>Torsten Husen, Psychological Twin Research: A Methodological Study (Stockholm: Almqvist and Wilsell, 1959), p. 87.

<sup>6</sup>Paul T. Wilson and Harold E. Jones, "Left-Handedness in Twins," Genetics, XVII (September, 1932), pp. 566-567.

<sup>7</sup>Shields, loc. cit.



characteristic of the identical pairs to share the same eye-hand pattern as well. In contrast to this the fraternal pairs tended to the same eye preference.

The relatively high incidence of mixed or left dominance in twins suggests the possibility of intra-uterine factors. While a considerable amount of literature has focused on the causes of left-handedness in twins no definitive conclusions have been reached.

### III. IMPLICATIONS

The conclusions from this study suggest certain implications which might be of value to teachers, particularly grade one teachers who have twins in their classrooms.

1. Effective teaching requires a knowledge not only of facts and techniques which may contribute to proficiency, but also comprehensive diagnosis and an understanding of individual learners. There is ample evidence from previous research to support the hypothesis that twins differ from a normal population of singletons. This study has shown that an analysis of specific abilities suggested that the twins were deficient in various skills necessary to reading progress.

Leading educators and psychologists have made a valuable contribution in identifying certain atypical groups and focusing on their particular learning needs. Twins are special because heredity and environment have made them so. However, they are not usually considered atypical from an educational standpoint. An awareness by



teachers that twins may experience difficulties because of twinship would be the first step in minimizing difficulties. Moreover, this implies the necessity of diagnosing particular areas of weaknesses so that more precise and economical instruction could be carried out.

2. The observation that twins tended to similar performance may involve factors of a psychological nature. While members of a twin pair are actually two separate individuals there is a tendency for others to treat them as a unit. Thus, there is a need for their classmates to be encouraged by their teachers to adjust to each twin as an individual. In addition, the twin situation implies that a conscious effort by teachers to evaluate the actual potential of members of a twin pair could provide relevant information which would enable them to provide for any existing differences and lead them to more realistic expectancies in terms of achievement level.

3. The psychological relationship between twins operates in complex ways. It is reasonable to assume that the constant companionship twins provide for each other would cause them to depend on each other to the extent that the relationship could hinder development. In addition, the search for individual identity, particularly in regard to an identical pair, could cause one of a pair to be identified as "weaker" or "more stupid" when actually very little difference exists. This situation implies that consideration should be given to classroom placement of twins. For example, would placement in separate classrooms provide a situation which would help twins overcome their



dependence on each other or would the possible advantages accruing from the situation be negated by possible exaggeration of differences to the detriment of the "slower" twin?

4. It is usual in the schools of Edmonton that children are tested for hearing deficiency at the grade four level. Since the twins in this study indicated a hearing loss there is an obvious implication that an audiometric test for twins would be useful at school entrance. At this time, if hearing losses are discovered, they could be partially compensated for by advantageous seating and perhaps more emphasis on visual methods in learning to read.

5. It has been assumed that twins have not been highly motivated to learn speech responses, since many of their needs, particularly social, are satisfied without verbal communication. If a hearing loss is typical of twins, it is possible that this may be a significant factor in their linguistic retardation, particularly in regard to articulation.

6. The conclusion that mixed dominance is characteristic of twins suggests that problems may arise which are attributable to this trait and which could hinder reading progress. Therefore, it would be a worthwhile procedure to attempt to determine lateral dominance in twins at school entrance. With appropriate instruction those individuals who indicated directional confusion could learn left to right sequence and make progress in reading consistent with their abilities.



### III. SUGGESTIONS FOR FURTHER RESEARCH

1. A study involving a large sampling of twins at various ages which investigated auditory acuity in twins would serve to contribute specific information as to whether incidence of hearing loss is true for a large population and if so, whether this may be a contributory cause of early language deficiency. The results of such a study could result in special teaching techniques for twins in the early grades.

2. A study similar to this one but on a larger scale would provide more conclusive evidence relating to reading proficiency in twins. Data concerning intelligence, socio-economic background, family size, general scholastic achievement, and language development would contribute valuable information regarding the relationship of these factors to reading achievement in twins and thus, would extend the range of interpretation.

3. Does the twin situation so limit the environment in the early years of rapid development that twins are always at a disadvantage? A longitudinal study designed to investigate the extent of change in reading ability would provide information which would indicate whether reading problems are characteristic of twins throughout their school years. Comparison with a population of singletons would determine to what extent, if at all, twins deviate from normal proficiency.

4. It has been observed that twins tend to linguistic



retardation. Insofar as reading depends on language adequacy, reading proficiency may be affected. An examination of language development in twins at school entrance in terms of ability to use basic sentence patterns, to expand these patterns and to elaborate them through manipulation of movable elements and the subsequent relationship to reading progress would possibly have implications for extended language training in the readiness program.

5. A study to determine the relationship between linguistic deficiency in twins and their performance on intelligence tests would provide information as to what extent, if any, the below normal intellectual development observed in twins in previous research may be accounted for by retarded language development.

6. A study designed to assess personality development and reading achievement so that comparisons could be made between twins who are in the same classroom and twins who are in separate classrooms could reveal relevant information concerning the conditions for the most effective learning and have implications for classroom placement.

#### IV. CONCLUDING STATEMENT

This study has focused attention on the reading abilities of twins during the initial stage of learning to read. It is significant that the study has shown that certain patterns of performance suggest that twins generally may experience difficulties in learning to read. However, it is equally significant that the deficiencies are of a



nature which suggest they could be eliminated or at least minimized so that reading disability need not be characteristic of performance at later levels. This, of course, would involve an awareness on the part of those who are concerned with teaching twins, that they are in fact an atypical group and effective teaching would involve a knowledge of problems characteristic of the group, as well as insight into any specific problems relating to the individuals within the group.



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Appendix

APPENDIX



THE HARRIS TESTS OF LATERAL DOMINANCE

Record Blank

Name.....Age.....Date.....Examiner.....

1. Knowledge of Left and Right  
R hand..... L ear..... R eye.....  
HAND DOMINANCE

2. Hand Preferences R.....%  
.1 Throw a ball .....  
.2 Wind a watch .....  
.3 Hammer a nail .....  
.4 Brush teeth .....  
.5 Comb hair .....  
.6 Turn door knob .....  
.7 Hold eraser .....  
.8 Use scissors .....  
.9 Cut with knife .....  
.10 Write .....

3. Simultaneous Writing  
No. of Reversals:  
R..... L.....  
Co-ordination better: .....

4. Handwriting  
Time: R..... L.....  
Co-ordination better: .....

5. Tapping  
Number: R..... L.....  
Co-ordination better: .....

6. Dealing Cards  
Time: R..... L.....  
Co-ordination better: .....

7. Strength of Grip (optional)  
R..... L..... R..... L.....

EYE DOMINANCE

8. Monocular Tests  
.1 Kaleidoscope .....  
.2 Telescope .....  
.3 Sight rifle .....  
Eye .....  
Shoulder .....

9. Binocular Tests  
.1 Cone: .....  
.2 Hole: .....

10. Stereoscopic Tests (optional)  
.1 Teleb: R.....% L.....% Supp?.....

FOOT DOMINANCE

11.1 Kick  
Pref..... Other..... Better.....

11.2 Stamp  
Foot used.....

RATINGS					
Test					
1	KNOWLEDGE OF LEFT AND RIGHT				
	:	:	:	:	:
	Confused	Hesitant	Normal		
2	HAND DOMINANCE				
	:	:	:	:	:
	L	L	M	R	R
3	:	:	:	:	:
	L	L	M	R	R
	:	:	:	:	:
4	:	:	:	:	:
	L	L	M	R	R
	:	:	:	:	:
5	:	:	:	:	:
	L	L	M	R	R
	:	:	:	:	:
6	:	:	:	:	:
	L	L	M	R	R
	:	:	:	:	:
7	:	:	:	:	:
	L	L	M	R	R
8	EYE DOMINANCE				
	:	:	:	:	:
	L	L	M	R	R
9	:	:	:	:	:
	L	L	M	R	R
	:	:	:	:	:
10	:	:	:	:	:
	L	L	M	R	R
11	FOOT DOMINANCE				
	:	:	:	:	:
	L	L	M	R	R
11.1	:	:	:	:	:
	L	L	M	R	R
	:	:	:	:	:
11.2	:	:	:	:	:

Family Background:

Conversion:

Qualitative Comments:



Name.....

Hand.....Time.....sec.

Name.....

Hand.....Time.....sec.

## TAPPING

[illegible][illegible]

R Hand  $\rightarrow$

A large grid consisting of 5 rows and 20 columns of squares. On the left side, there are two curved arrows pointing towards the grid, one between the first and second rows, and another between the third and fourth rows. On the right side, there are also two curved arrows pointing towards the grid, one between the first and second rows, and another between the third and fourth rows.

L Hand

A 5x20 grid representing a 2D lattice. The top edge is labeled "L Hand" with an arrow pointing left. The right edge has three arrows pointing right. The left edge has three arrows pointing left.

[illegible][illegible]

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# AUDITORY DISCRIMINATION TEST

## FORM I

			X	Y
1.	tub	- tug		
2.	lack	- lack		
3.	web	- wed		
4.	leg	- led		
5.	chap	- chap		
6.	gum	- dumb		
7.	bale	- gale		
8.	sought	- fought		
9.	vow	- thou		
10.	shake	- shape		
11.	zest	- zest		
12.	wretch	- wretch		
13.	thread	- shred		
14.	jam	- jam		
15.	bass	- bath		
16.	tin	- pin		
17.	pat	- pack		
18.	dim	- din		
19.	coast	- toast		
20.	thimble	- symbol		

			X	Y
21.	cat	- cap		
22.	din	- bin		
23.	lath	- lash		
24.	bum	- bomb		
25.	clōthe	- clōve		
26.	moon	- noon		
27.	shack	- sack		
28.	sheaf	- sheath		
29.	king	- king		
30.	badge	- badge		
31.	pork	- cork		
32.	fie	- thigh		
33.	shoal	- shawl		
34.	tall	- tall		
35.	par	- par		
36.	pat	- pet		
37.	muff	- muss		
38.	pose	- pose		
39.	lease	- leash		
40.	pen	- pin		

Error Score

X

Y

30

Y

X

10

Name of Child:

Date Tested:

Examiner's Name:

Age:

Date of Birth:

Grade:

Name of School:

Disabilities:

Hearing:

Reading:

Speaking:

Other:

I.Q.:

Test:

Error Score:

	X	Y
Form C	<div>30</div>	<div>10</div>
Form D	<div>30</div>	<div>10</div>

Additional Comments:

DOLCH BASIC SIGHT WORD LIST OF 220 SERVICE WORDS

a	be	call	eat	gave
about	because	came	eight	get
after	been	can	every	give
again	before	carry	fall	go
all	best	clean	far	goes
always	better	cold	fast	going
am	big	come	find	good
an	black	could	first	got
and	blue	cut	five	green
any	both	did	fly	grow
are	bring	do	for	had
around	brown	does	found	has
as	but	done	four	have
ask	buy	don't	from	he
at	by	down	full	help
ate		draw	funny	her
away		drink		here
				him



his	laugh	never	pick
hold	let	new	play
hot	light	no	please
how	like	not	pretty
hurt	little	now	pull
I	live	of	put
if	long	off	ran
in	look	old	read
into	made	on	red
is	make	once	ride
it	many	one	right
its	may	only	round
jump	me	open	run
just	much	or	said
keep	must	our	saw
kind	my	out	say
know	myself	over	see
		own	seven



shall	their	under	when
she	them	up	where
show	then	upon	which
sing	there	us	white
sit	these	use	who
six	they	very	why
sleep	think	walk	will
small	this	want	wish
so	those	warm	with
some	three	was	work
soon	to	wash	would
start	today	we	write
stop	together	well	yellow
take	too	went	yes
tell	try	were	you
ten	two	what	your
thank			
that			
the			



SCHONELL GRADED READING VOCABULARY TEST

tree	little	milk	egg	book
school	sit	frog	playing	bun
flower	road	clock	train	light
picture	think	summer	people	something
dream	downstairs	biscuit	shepherd	thirsty
crowd	sandwich	beginning	postage	island
saucer	angel	ceiling	appeared	gnome
canary	attractive	imagine	nephew	gradually
smoulder	applaud	disposal	nourished	diseased
university	orchestra	knowledge	audience	situated
physics	campaign	choir	intercede	fascinate
forfeit	seige	recent	plausible	prophecy
colonel	soloist	systematic	slovenly	classification
genuine	institution	pivot	conscience	heroic
pneumonia	preliminary	antique	susceptible	enigma
oblivion	scintellate	satirical	sabre	beguile
terrestrial	belligerent	adamant	sepulchre	statistic
miscellaneous	procrastinate	tyrannical	evangelical	grotesque
ineradicable	judicature	preferential	homonym	fictitious
rescind	metamorphosis	somnambulist	bibliography	idiosyncrasy



EXAMINER’S RECORD BOOKLET

for the

GRAY ORAL READING TEST

FORM A

Name\_\_\_\_\_Grade\_\_\_\_\_Age\_\_\_\_\_

School\_\_\_\_\_Teacher\_\_\_\_\_Sex\_\_\_\_\_

City\_\_\_\_\_State\_\_\_\_\_

Examiner\_\_\_\_\_Date\_\_\_\_\_

SUMMARY

Pas- sage Number	No. of Errors	Time (in Seconds)	Pas- sage Scores	Compre- hension
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
Total Passage Scores				
Grade Equivalent				

TYPES OF ERRORS

1.	Aid	
2.	Gross Mispronunciation	
3.	Partial Mispronunciation	
4.	Omission	
5.	Insertion	
6.	Substitution	
7.	Repetition	
8.	Inversion	

OBSERVATIONS

(Check statement and circle each part)

- ☐ Word-by-word reading
- ☐ Poor phrasing
- ☐ Lack of expression
- ☐ Monotonous tone
- ☐ Pitch too high or low; voice too loud,  
too soft, or strained
- ☐ Poor enunciation
- ☐ Disregard of punctuation
- ☐ Overuse of phonics
- ☐ Little or no method of word analysis
- ☐ Unawareness of errors
- ☐ Head movement
- ☐ Finger pointing
- ☐ Loss of place

COMMENTS:\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



THE **BOBBS-MERRILL** COMPANY, INC.  
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A. 1. Look, Mother, look.  
See me go.  
I go up.  
I come down.  
Come here, Mother.  
Come and play with me.

Time \_\_\_\_\_ Seconds

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Questions

Answers

- \_\_\_1. What was the girl in this story doing?

Swinging *or* going up and down (1)  
Showing her mother how she  
could swing (½)
- \_\_\_2. Who was she talking to?

(Her) Mother (1)
- \_\_\_3. What two things did the girl ask Mother  
to see her do?

Go up and come down *or*  
I go up and down (1)
- \_\_\_4. Who was Mother to play with?

The girl (question *her or me*) (1)

Number Right \_\_\_\_\_

A. 2. A boy said, "Run, little girl.  
Run with me to the boat."  
They ran and ran.  
"This is fun," said the boy.  
"Look," said the girl.  
"I see something in the boat.  
It is my kitten.  
She wants to play."

Time \_\_\_\_\_ Seconds

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Questions

Answers

- \_\_\_1. Where did the boy want the girl to run?

To the boat (1)
- \_\_\_2. Who said it was fun to run?

The boy (1)
- \_\_\_3. What was in the boat?

A kitten *or* her kitten (1)  
Boy's kitten (½)
- \_\_\_4. Who saw the kitten first?

The girl (1)

Number Right \_\_\_\_\_

A. 3. One morning a boy made a boat. "Where can I play with it?" he asked.  
Father said, "Come with me in the car! We will take your boat with us."  
Soon the boy called, "Please stop. I see water. May I play here?"  
"Yes," said Father. "Have a good time."

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
___1. What did the boy make one morning?	A boat (1)	_____
___2. What did he say he wanted to do with it?	Play with it (1) Sail it <i>or</i> float it, <i>or</i> put it in water (½)	_____
___3. What did the boy see as they rode in the car?	Water (1) Lake (½); pond (½)	_____
___4. When he saw the water what did he ask his father to do?	Stop <i>or</i> stop and let him play (1) Let him play (½)	_____

Number Right \_\_\_\_\_

A. 4. One day five children went out to play in the beautiful white snow. They played for a long time and then began to make snow animals.  
One of the animals was a dog. Soon the dog next door came out of the house. When he saw the snow dog he said, "Bow-wow."  
The children laughed. "Now we have a dog that can bark."

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
___1. In what were the children playing?	(Beautiful) (white) snow (1)	_____
___2. What did they make out of the snow?	(Snow) animals; (1) A dog <i>or</i> snow dog (½)	_____
___3. While they were playing what came out of a house?	A dog (real), (live), (neighbor's), (another) (1)	_____
___4. What did the children say the real dog could do?	Bark <i>or</i> say bow-bow (1)	_____

Number Right \_\_\_\_\_

A. 5. It was pet day at the fair. The children were waiting for the parade of animals to begin. They had trained their pets to do many different tricks. Among them was a tall boy whose goat made trouble for him. It kicked and tried hard to break away. When it heard the band it became quiet. During the parade it danced so well that it won a prize.

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
___1. What day was it at the fair?	Pet (day) (1) Animal (day) <i>or</i> animal parade (day) ( $\frac{1}{2}$ )	_____
___2. What had the children trained their pets to do?	(To do) (many) (different) tricks (1) Dance <i>or</i> do many things ( $\frac{1}{2}$ )	_____
___3. What animal made trouble for one boy?	A goat <i>or</i> his goat (1)	_____
___4. What did the goat do that won a prize?	Danced (in the parade) (1)	_____

Number Right \_\_\_\_\_

A. 6. Airplane pilots have many important jobs. They fly passengers, freight, and mail from one city to another. Sometimes they make dangerous rescues in land and sea accidents, and drop food where people or herds are starving. They bring strange animals from dense jungles to our zoos. They also serve as traffic police and spot speeding cars on highways.

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
___1. Whom is this paragraph about?	Airplane pilots (1) Airplane pilot ( $\frac{1}{2}$ ), pilots ( $\frac{1}{2}$ ) Airplane driver ( $\frac{1}{2}$ )	_____
___2. What do they take from city to city?	Passengers, mail, freight (any two of these) (1) Mail <i>or</i> freight <i>or</i> animals and food ( $\frac{1}{2}$ ) Passengers and food ( $\frac{1}{2}$ )	_____
___3. What kind of rescues are sometimes made in land and sea accidents?	Dangerous (1)	_____
___4. What do airplane pilots do when serving as traffic police?	Look for ( <i>or</i> spot) speeding cars (1) Track ( <i>or</i> stop) speeding cars ( $\frac{1}{2}$ ) Stop cars (0)	_____

Number Right \_\_\_\_\_

A. 7. Hundreds of years ago, most of Europe was a very poor region. But China, a large country in eastern Asia, had many of the comforts of a rich civilized nation. Only a few people from Europe had visited this distant region. One was the famous Marco Polo. He learned some of the languages that were spoken in China and served its great ruler for many years.

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
—1. What kind of region was most of Europe hundreds of years ago?	(Very) poor (1)	_____
—2. What country enjoyed far more comforts than Europe?	China (1)	_____
—3. Who was one of the few people from Europe who visited China?	Marco Polo (1) Marco (½), Polo (½)	_____
—4. What did Marco Polo learn in China?	Some <i>or</i> a few of the languages (1) The language (½) Many of ( <i>or</i> the) languages of China (½) Different languages (½)	_____

Number Right \_\_\_\_\_

A. 8. The eager spectators who had cheered the plucky Warriors through eight hard-fought innings were silent. Only a run was required to defeat the much feared Champions, who had previously defeated all opponents. The spectators had earlier criticized the umpire severely. Now their faces were tense with excitement as the players took their positions.

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
—1. How had the spectators encouraged the plucky Warriors?	(By) cheering <i>or</i> cheered (1)	_____
—2. How many runs were needed to defeat the Champions?	One <i>or</i> a run (1)	_____
—3. Whom had the spectators criticized early in the game?	The umpire (1)	_____
—4. How did the faces of the spectators look as the players took their positions?	Tense (with excitement) <i>or</i> sullen (1) Serious (½)	_____

Number Right \_\_\_\_\_

A. 13. During a hiatus (hī ā'tūs) in the desultory (dēs'ŭl tō'rī; esp. British . . . tēr i) firing, the apt lieutenant clambered wearily over the detritus (dê trī'tūs) piled against the redoubts (rê douts'). Beneath a canopy of empyrean (ěm'pī rē'ăn; ěm'pī rē' . . .) blue lay the quiet, bucolic (bû-kōl'ik) landscape, its pristine (prīs'tēn; . . . tīn) beauty now defiled by myriad (mīr'ī ād) diminutive (dī mīn'û tīv) promontories thrown up by the mortar shells, but radiating momentarily an inexplicable (īn ěks'plī kà b'l) if spurious (spū' rī ūs) calm and peace.

TYPES OF ERRORS	NUMBER
1. Aid	
2. Gross Mispronunciation	
3. Partial Mispronunciation	
4. Omission	
5. Insertion	
6. Substitution	
7. Repetition	
8. Inversion	
Total Errors	

Time \_\_\_\_\_ Seconds

Questions	Answers	
___1. When did the lieutenant crawl over the detritus?	During the hiatus <i>or</i> gap <i>or</i> lull in the firing (1) When it was quiet (½) After the firing (½)	_____
___2. What was the color of the sky?	Empyrean <i>or</i> heavenly blue (1) Blue (½)	_____
___3. What marred the beauty of the landscape?	Diminutive <i>or</i> (very) small promontories <i>or</i> mounds (1)	_____
___4. By what had these promontories been made?	Mortar shells (1)	_____

Number Right \_\_\_\_\_

# Durrell Analysis of Reading Difficulty

NEW EDITION

## INDIVIDUAL RECORD BOOKLET

BY Donald D. Durrell *Professor of Education and Director of Educational Clinic, Boston University*

NAME \_\_\_\_\_

DATE \_\_\_\_\_

SCHOOL \_\_\_\_\_

EXAMINER \_\_\_\_\_

AGE \_\_\_\_\_ GRADE \_\_\_\_\_

REPORT TO \_\_\_\_\_

DATE OF BIRTH \_\_\_\_\_

ADDRESS \_\_\_\_\_

### Profile Chart

GRADE	READING ANALYSIS TESTS							ADDITIONAL TESTS							AGE	
	Reading		Listen- ing	Flash Words	Word Analysis	Spell- ing	Hand- writing	Durrell-Sullivan		Revised Stanford-Binet						
	Oral	Silent						Capacity		Achievement						
								Word	Para.	Word	Para.	Vocab.	M.A.			
H															12-0	
6.5 M															11-8	
L															11-4	
6.0															11-2	
H															11-0	
5.5 M															10-8	
L															10-4	
5.0															10-2	
H															9-11	
4.5 M															9-8	
L															9-5	
4.0															9-2	
H															9-0	
3.5 M															8-8	
L															8-5	
3.0															8-2	
H															8-0	
2.5 M															7-9	
L															7-5	
2.0															7-3	
H															7-0	
1.5 M															6-9	
L															6-6	
Record scores here →																

# Check List of Instructional Needs

## NON-READER OR PREPRIMER LEVEL

### Needs help in:

1. Listening comprehension and speech
  - \_\_\_ Understanding of material heard
  - \_\_\_ Speech and spoken vocabulary
2. Visual perception of word elements
  - \_\_\_ Visual memory of words
  - \_\_\_ Giving names of letters
  - \_\_\_ Identifying letters named
  - \_\_\_ Matching letters
  - \_\_\_ Copying letters
3. Auditory perception of word elements
  - \_\_\_ Initial or final blends
  - \_\_\_ Initial or final single sounds
  - \_\_\_ Learning sounds taught
4. Phonic abilities
  - \_\_\_ Solving words
  - \_\_\_ Sounding words
  - \_\_\_ Sounds of blends — phonograms
  - \_\_\_ Sounds of individual letters
5. Learning rate
  - \_\_\_ Remembering words taught
  - \_\_\_ Use of context clues
6. Reading interest and effort
  - \_\_\_ Attention and persistence
  - \_\_\_ Self-directed work
7. Other
  - \_\_\_
  - \_\_\_
  - \_\_\_
  - \_\_\_
  - \_\_\_

## PRIMARY GRADE READING LEVEL

### Needs help in:

1. Listening comprehension and speech
  - \_\_\_ Understanding of material heard
  - \_\_\_ Speech and spoken vocabulary
2. Word analysis abilities
  - \_\_\_ Visual memory of words
  - \_\_\_ Auditory analysis of words
  - \_\_\_ Solving words by sounding
  - \_\_\_ Sounds of blends, phonograms
  - \_\_\_ Use of context clues
  - \_\_\_ Remembering new words taught
3. Oral reading abilities
  - \_\_\_ Oral reading practice
  - \_\_\_ Comprehension in oral reading
  - \_\_\_ Phrasing (Eye-voice span)
  - \_\_\_ Errors on easy words
  - \_\_\_ Addition or omission of words
  - \_\_\_ Repetition of words or phrases
  - \_\_\_ Ignoring punctuation
  - \_\_\_ Ignoring word errors
  - \_\_\_ Attack on unfamiliar words
  - \_\_\_ Expression in reading
  - \_\_\_ Speech, voice, enunciation
  - \_\_\_ Security in oral reading
4. Silent reading and recall
  - \_\_\_ Level of silent reading
  - \_\_\_ Comprehension in silent reading
  - \_\_\_ Attention and persistence
  - \_\_\_ Unaided oral recall
  - \_\_\_ Recall on questions
  - \_\_\_ Speed of silent reading
  - \_\_\_ Phrasing (Eye movements)
  - \_\_\_ Lip movements and whispering
  - \_\_\_ Head movements Frowning
  - \_\_\_ Imagery in silent reading
  - \_\_\_ Position of book Posture
5. Reading interest and effort
  - \_\_\_ Attention and persistence
  - \_\_\_ Voluntary reading
  - \_\_\_ Self-directed work Workbooks

## INTERMEDIATE GRADE READING LEVEL

### Needs help in:

1. Listening comprehension and speech
  - \_\_\_ Understanding of material heard
  - \_\_\_ Speech and oral expression
2. Word analysis abilities and spelling
  - \_\_\_ Visual analysis of words
  - \_\_\_ Auditory analysis of words
  - \_\_\_ Solving words by sounding syllables
  - \_\_\_ Sounding syllables, word parts
  - \_\_\_ Meaning from context
  - \_\_\_ Attack on unfamiliar words
  - \_\_\_ Spelling ability
  - \_\_\_ Accuracy of copy Speed of writing
  - \_\_\_ Dictionary skills: Location, pronunciation, meaning
3. Oral reading abilities
  - \_\_\_ Oral reading practice
  - \_\_\_ Comprehension in oral reading
  - \_\_\_ Phrasing (Eye-voice span)
  - \_\_\_ Expression in reading Speech skills
  - \_\_\_ Speed of oral reading
  - \_\_\_ Security in oral reading
  - \_\_\_ Word and phrase meaning
4. Silent reading and recall
  - \_\_\_ Level of silent reading
  - \_\_\_ Comprehension in silent reading
  - \_\_\_ Unaided oral recall
  - \_\_\_ Unaided written recall
  - \_\_\_ Recall on questions
  - \_\_\_ Attention and persistence
  - \_\_\_ Word and phrase meaning difficulties
  - \_\_\_ Sentence complexity difficulties
  - \_\_\_ Imagery in silent reading
5. Speeded reading abilities
  - \_\_\_ Speed of reading (Eye movements)
  - \_\_\_ Speed of work in content subjects
  - \_\_\_ Skimming and locating information
6. Study abilities
  - \_\_\_ Reading details, directions, arithmetic
  - \_\_\_ Organization and subordination of ideas
  - \_\_\_ Elaborative thinking in reading
  - \_\_\_ Critical reading
  - \_\_\_ Use of table of contents References
7. Reading interest and effort
  - \_\_\_ Voluntary reading
  - \_\_\_ Variety of reading
  - \_\_\_ Self-directed work

# General History Data

## SCHOOL RECORD

Age at school entrance \_\_\_\_\_  
 First-grade absences \_\_\_\_\_  
 Recent absences \_\_\_\_\_  
 School report (or classroom visit) \_\_\_\_\_

Onset of difficulty \_\_\_\_\_  
 Schools attended \_\_\_\_\_  
 Reading method used \_\_\_\_\_  
 Poor discipline \_\_\_\_\_  
 Discouraged \_\_\_\_\_

## MEDICAL RECORD

Latest examination of eyes \_\_\_\_\_ by \_\_\_\_\_

Clinic examination suggests:

Nearsightedness \_\_\_\_\_  
 Farsightedness \_\_\_\_\_  
 Astigmatism \_\_\_\_\_  
 Coördination difficulty \_\_\_\_\_

Hearing \_\_\_\_\_  
 Auditory discrimination \_\_\_\_\_  
 Pertinent medical history \_\_\_\_\_

## PSYCHOLOGICAL FACTORS — HOME HISTORY

Source \_\_\_\_\_

Siblings — where in school? \_\_\_\_\_  
 Handedness change \_\_\_\_\_  
 Emotional reactions \_\_\_\_\_  
 Special interests \_\_\_\_\_  
 Tutoring possibilities \_\_\_\_\_  
 Previous tutoring \_\_\_\_\_

## REMEDIAL PLANS

(Individual tutoring — small group work — remedial class)

1. Level of reading materials \_\_\_\_\_
2. Motivation type — interests \_\_\_\_\_
3. Word work
  - Word analysis — level, type \_\_\_\_\_
  - Immediate recognition \_\_\_\_\_
  - Phrase work \_\_\_\_\_
4. Oral reading plans
  - Mechanics \_\_\_\_\_
  - Comprehension \_\_\_\_\_
5. Silent reading plans
  - Mechanics \_\_\_\_\_
  - Comprehension \_\_\_\_\_
6. Study skills
  - Thoroughness \_\_\_\_\_
  - Flexibility \_\_\_\_\_
  - Association \_\_\_\_\_

# Oral Reading

**INSTRUCTIONS.** Make a record of time, errors, phrasing, and comprehension according to the directions in the Manual.

1. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	1			L	2		
	L	M	H		L	M	H
TIME	50	38	30		27	20	15

Muff is a little yellow kitten.

She drinks milk.

She sleeps on a chair.

She does not like to get wet.

- \_\_\_ 1. What color was the kitten?
- \_\_\_ 2. What does she drink?
- \_\_\_ 3. Where does she sleep?
- \_\_\_ 4. Why doesn't Muff like to go out on rainy days?

2. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	1			L	2		
	L	M	H		L	M	H
TIME	90	75	60		55	41	30

A little black dog ran away from home. He played with two big dogs. They ran away from him. It began to rain. He went under a tree. He wanted to go home, but he did not know the way. He saw a boy he knew. The boy took him home.

- \_\_\_ 1. Who ran away from home?
- \_\_\_ 2. How many other dogs did he play with?
- \_\_\_ 3. Why did the dog go under the tree?
- \_\_\_ 4. What did the dog want then?
- \_\_\_ 5. Whom did he see?
- \_\_\_ 6. How did he get home?

3. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	2			L	3		
	L	M	H		L	M	H
TIME	65	50	40		35	25	20

Six boys put up a tent by the side of the river. They took things to eat with them. When the sun went down, they went into the tent to sleep. In the night, a cow came and began to eat grass around the tent. The boys were afraid. They thought it was a bear.

- \_\_\_ 1. How many boys went camping?
- \_\_\_ 2. Where did they put up their tent?
- \_\_\_ 3. What did they take with them besides their tent?
- \_\_\_ 4. What did the boys do when the sun went down?
- \_\_\_ 5. What came around their tent in the night?
- \_\_\_ 6. What was the cow doing?
- \_\_\_ 7. What did the boys think the cow was?

4. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	3			L	4		
	L	M	H		L	M	H
TIME	70	40	32		30	27	24

Henry goes to a large lake in summer. Last summer, a motorboat sank near his house. The boat had ten men in it. The man who was running the boat brought it very close to the shore when the water was low. He hit a big rock under water. It made a hole in the bottom of the boat. The water came in very fast. All of the men swam to shore.

- \_\_\_ 1. Where does Henry go in summer?
- \_\_\_ 2. What happened near his house?
- \_\_\_ 3. What kind of boat was it?
- \_\_\_ 4. What did the boat hit?
- \_\_\_ 5. How fast did the water come in?
- \_\_\_ 6. How many men were on the boat?
- \_\_\_ 7. What happened to the men on the boat?

5. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	3			L	4			L	5		
	L	M	H		L	M	H		L	M	H
TIME	70	50	42		40	35	30		27	25	22

In 1807, Robert Fulton took the first long trip in a steamboat. He went one hundred and fifty miles up the Hudson River. The boat went five miles an hour. This was faster than a steamboat had ever gone before. Crowds gathered on both banks of the river to see this new kind of boat go by. The fishermen did not like the boat. They were afraid that its noise and splashing would drive away all the fish.

- \_\_\_ 1. What did Robert Fulton do in this story?
- \_\_\_ 2. What kind of boat was it?
- \_\_\_ 3. What river was the trip made on?
- \_\_\_ 4. How far did the boat go?
- \_\_\_ 5. How fast did it go?
- \_\_\_ 6. Who did not like the boat?
- \_\_\_ 7. What were the fishermen afraid would happen?

Oral Reading

6. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	4			5	6	H
	L	M	H	L	M	H
TIME	90	75	65	60	55	52

The richest diamond field in the world is in South Africa. Deep pits yield a hard substance called "blue ground" which contains the diamonds. The blue ground is spread over the drying fields for a year. The weather gradually crumbles it. Then it is taken up and run through washing machines which sort out the stones and the diamonds. The value of the diamonds is determined by color, size, and purity. Blue, yellow, orange, brown, and green diamonds have been discovered. The most valuable ones are pure white. The largest diamond ever found weighed almost two pounds.

- 1. In what country is the richest diamond field of the world?
- 2. What is the substance containing the diamonds called?
- 3. Why is the blue ground spread over the drying fields?
- 4. What do the washing machines do?
- 5. What are some of the colors of diamonds?
- 6. Which diamonds are the most valuable?
- 7. How heavy was the largest diamond ever found?

7. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	5			6		
	L	M	H	L	M	H
TIME	80	72	65	60	55	42

Golf originated in Holland as a game played on ice. The game in its present form first appeared in Scotland. It became unusually popular and kings found it so enjoyable that it was known as "the royal game." James IV, however, thought that people neglected their work to indulge in this fascinating sport so that it was forbidden in 1457. James relented when he found how attractive the game was, and it immediately regained its former popularity. Golf spread gradually to other countries, being introduced in America in 1890. It has grown in favor until there is hardly a town that does not boast of a private or public course.

- 1. Where did golf originate?
- 2. How was it first played?
- 3. Where did it first appear in its present form?
- 4. Why was golf forbidden by James IV?
- 5. Why did he change his mind?
- 6. When was golf first introduced in America?
- 7. What evidence have we of its popularity?

8. Time \_\_\_\_\_ Errors \_\_\_\_\_ Comprehension \_\_\_\_\_

GRADE	6		
	L	M	H
TIME	90	65	50

Between 1865 and 1900, the northern part of the United States enjoyed great prosperity. Many new industries developed, among them the making of thread and ready-made clothes. The invention of machinery revolutionized methods of manufacture. For example, the introduction of the McKay sewing machine permitted the manufacture of shoes in big factories. Radical changes in steel-making allowed enormous expansion of the iron and steel industries. The Bessemer process of smelting was introduced into the country in 1864 and the open-hearth process in 1867. As a result, more machinery could be built, and factories became more productive.

- 1. What great development is described here?
- 2. When did this industrial growth take place?
- 3. What were some of the industries that arose?
- 4. In which part of the United States did this take place?
- 5. What invention increased the production of shoes?
- 6. What processes of steel making were used?
- 7. What effect did increased steel production have on industry?

CHECK LIST OF DIFFICULTIES

- PHRASE READING

  - Word-by-word reading
  - Inadequate phrasing
  - Incorrect phrasing
  - Eye-voice span too short
- WORD SKILLS IN ORAL READING

  - Low sight vocabulary
  - Word-analysis ability inadequate
  - Errors on easier words
  - Guesses at unknown words from context
  - Ignores word errors and reads on
  - Poor enunciation of prompted words
- VOICE, ENUNCIATION, EXPRESSION

  - Strained, high-pitched voice
  - Monotonous tone
  - Volume too loud
  - Volume too soft
  - Poor enunciation in all reading
  - Poor enunciation of difficult words
  - Ignores punctuation
  - Habitual repetition of words
  - Habitual addition of words
  - Omits words
  - Marked insecurity evident
- GENERAL READING HABITS

  - Head movements; marked
  - Loses place easily
  - Uses finger or pointer
  - Holds book too close or incorrectly
  - Frowns and shows signs of tenseness
  - Poor posture
  - Effort and attention low
  - Easily distracted

ORAL READING TIME		COMPREHENSION
Paragraph No.	Grade Level	
_____	_____	Good
_____	_____	Fair
_____	_____	Poor
_____	_____	
Median Grade	_____	

# Silent Reading

**INSTRUCTIONS.** Make a record of time, errors, number of unaided memories, inaccurate memories, and prompted memories according to the directions in the Manual.

## 1. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	1			2		
	L	M	H	L	M	H
TIME	45	35	27	24	18	13
MEMORIES	4			5		

Peter is.....  
 a big white rabbit. ....  
 He has long ears. ....  
 He has a little tail. ....  
 He can jump and hop. ....

## 2. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	1			2		
	L	M	H	L	M	H
TIME	81	60	53	47	37	28
MEMORIES	7			10		

A hen had.....  
 six little yellow chickens. ....  
 One morning.....  
 she took them for a walk. ....  
 They looked for.....  
 something to eat. ....  
 They found some seeds and  
 sand. ....  
 A dog came.....  
 to play with them. ....  
 The hen.....  
 did not like the dog. ....  
 She flew at the dog.....  
 and made him run away. ....

## 3. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	2			3		
	L	M	H	L	M	H
TIME	62	50	35	30	23	16
MEMORIES	7			10		

Three boys.....  
 built a house.....  
 in the woods. ....  
 They put a table.....  
 and two old chairs in it. ....  
 There was a basket.....  
 full of apples. ....  
 under the table. ....  
 One afternoon.....  
 they went away.....  
 and left the door open. ....  
 When they came back, ....  
 they found two little pigs.....  
 eating the apples. ....

## 4. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	3			4		
	L	M	H	L	M	H
TIME	45	35	30	26	23	18
MEMORIES	12			15		

A little girl.....  
 got off the train .....  
 all alone. ....  
 There was nobody.....  
 at the station.....  
 to meet her. ....  
 She asked the man.....  
 inside the station.....  
 where her mother was. ....  
 He said that her mother.....  
 could not get the car started. ....  
 A man was trying to fix it. ....  
 The little girl sat down.....  
 to wait. ....  
 A few minutes later .....  
 a big car .....  
 came around the corner.....  
 with her mother in it. ....  
 The little girl got in.....  
 and they drove home. ....

## 5. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	3			4			5		
	L	M	H	L	M	H	L	M	H
TIME	62	40	36	34	30	28	26	23	18
MEMORIES	10			12			15		

About one hundred and fifty .....  
 years ago,.....  
 in France,.....  
 the first man .....  
 went up in a balloon. ....  
 His balloon was made of  
 paper.....  
 covered with strips of cloth. ....  
 to make it strong. ....  
 A long rope kept it.....  
 from going too high. ....  
 Later this man took a friend .....  
 up in the balloon with him. ....  
 On this trip they rose.....  
 over five hundred feet. ....  
 The trip lasted.....  
 thirty minutes. ....  
 They came down.....  
 several miles.....  
 from where they started. ....

## Imagery Questions (OPTIONAL)

### PARAGRAPH 3

1. Did you see in your mind the three boys who built the house in the woods? Tell me how they looked to you. Then ask: How old were they? How were they dressed? etc.
2. Did you see the house in your mind? Tell me about how it looked to you. Then ask: How big was it? Did it have any windows? How many? What kind of roof did it have? Could you draw a picture of how the house looked to you? etc.

### PARAGRAPH 4

1. Did you see in your mind the little girl who got off the train? Tell me how she looked. (How dressed; various articles of clothing; color; hair; age; size; luggage; etc.)
2. Did you see any other people? Tell me how they look.
3. Did you see the station and the surroundings? Tell me what you saw.

### RESPONSE TO IMAGERY QUESTIONS

- \_\_\_\_ Rich flow of imagery  
 \_\_\_\_ Hesitant, indefinite

Silent Reading

Time _____			Memories _____						
GRADE	4			5			6		
	L	M	H	L	M	H	L	M	H
TIME	70	55	47	43	38	30	27	24	18
MEMORIES	10			13			16		

Early settlers.....  
in America.....  
found that Indians.....  
could sell skins and land.....  
for glass beads.....  
Many men earned their liv-  
ing.....  
by making glass beads.....  
and bottles.....  
in 1827.....  
a man invented a way.....  
to press molten glass.....  
into iron molds.....  
The most famous glass works.....  
was in the town of Sand-  
wich in Massachusetts.....  
The Sandwich glass had.....  
a bright silvery appearance.....  
and it could be molded into.....  
very elaborate and attractive  
patterns.....  
Beautiful lamps and candle-  
sticks.....  
as well as all sorts of dishes.....  
were made from this glass.....  
in many New England homes.....  
pieces of Sandwich glass.....  
are still found on display.....

CHECK LIST OF DIFFICULTIES

MECHANICS OF SILENT READING

- \_\_\_ Low rate of silent reading
- \_\_\_ High rate at the expense of mastery
- \_\_\_ Lip movements; constant — occasional
- \_\_\_ Whispering; constant — occasional
- \_\_\_ Lacks persistence in hard material
- \_\_\_ Marked insecurity evident
- \_\_\_ Poor attention necessitates rereading

RECALL

- \_\_\_ Unaided recall scanty
- \_\_\_ Poorly organized recall
- \_\_\_ Inaccurate memories and guesses
- \_\_\_ Response labored and slow
- \_\_\_ Avoids use of new words in recall
- \_\_\_ Recalls details badly in questions
- \_\_\_ Very scanty recall on hard material

7. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	5			6		
	L	M	H	L	M	H
TIME	60	46	40	37	33	24
MEMORIES	9			14		

Basketball.....  
is one of the more recent  
games.....  
It was devised.....  
by a college instructor.....  
who desired a game to inter-  
pose.....  
between the football.....  
and baseball seasons.....  
The game demands.....  
precision of movement.....  
concentration.....  
and great endurance.....  
It is more popular.....  
in those localities where.....  
it does not compete with  
hockey.....  
Opinion differs as to whether.....  
it is a satisfactory game.....  
for girls.....  
It has been modified.....  
to make it less strenuous.....  
for them.....  
by restricting the playing  
area.....  
of each player.....  
Some of the large Western.....  
universities.....  
have audiences.....  
of over twenty thousand.....  
at their conference games.....

EYE MOVEMENTS

- Range of eye movements per line \_\_\_\_\_ to \_\_\_\_\_
- \_\_\_ Irregular pauses
- \_\_\_ Regressive movements

COMPARISON WITH ORAL READING (Underline)

- Speed: higher — same — lower
- Recall: better — same — poorer
- Security: better — same — poorer

8. Time \_\_\_\_\_ Memories \_\_\_\_\_

GRADE	6		
	L	M	H
TIME	60	45	35
MEMORIES	12		

Railroad communication.....  
developed rapidly.....  
just after the Civil War.....  
Between 1865 and 1873.....  
thirty-five thousand.....  
miles of track were laid.....  
This doubled the distance.....  
people could travel.....  
by railroad.....  
Some of the new roads.....  
connected important cities.....  
and some extended westward.....  
beyond populated regions.....  
Congress.....  
favored this sudden.....  
development.....  
by granting land to com-  
panies.....  
interested in furthering.....  
the expansion.....  
Grants included territory.....  
lying within twenty miles.....  
of the proposed roadbed.....  
Alternate sections.....  
were allotted to the railroad;  
those in between were.....  
reserved for homesteaders.....  
The sale of sections of land.....  
owned by the railroad.....  
was made easier.....  
through this checkerboard.....  
arrangement.....

SILENT READING TIME		COMPREHENSION
Paragraph No.	Grade Level	
_____	_____	___ Good
_____	_____	___ Fair
_____	_____	___ Poor
_____	_____	
Median Grade	_____	

# Listening Comprehension

**INSTRUCTIONS.** Make a record of the comprehension questions answered correctly according to the directions in the Manual.

## GRADE 1 READING LEVEL

### The Cat and the Dog

- \_\_\_ 1. What did the boy have?
- \_\_\_ 2. What was he going to give her?
- \_\_\_ 3. What happened when he called to her?
- \_\_\_ 4. Where was the cat?
- \_\_\_ 5. What was she doing?
- \_\_\_ 6. What did the boy do then?
- \_\_\_ 7. What happened next?

## GRADE 2 READING LEVEL

### Dick's Birthday Present

- \_\_\_ 1. What did Dick do when he woke up?
- \_\_\_ 2. What day was it?
- \_\_\_ 3. What did he find on his chair?
- \_\_\_ 4. What did Dick hear?
- \_\_\_ 5. What did Dick do then?
- \_\_\_ 6. What was in the basket?
- \_\_\_ 7. What did the dog do?

## GRADE 3 READING LEVEL

### The Accident

- \_\_\_ 1. What was this story about?
- \_\_\_ 2. What had the boy been doing?
- \_\_\_ 3. What was he riding?
- \_\_\_ 4. What came down the road?
- \_\_\_ 5. Why didn't he see the car coming?
- \_\_\_ 6. How fast was the car going?
- \_\_\_ 7. What happened to the boy?
- \_\_\_ 8. What happened to the bicycle?

## GRADE 4 READING LEVEL

### Peter Cooper's Engine

- \_\_\_ 1. What did Peter Cooper build?
- \_\_\_ 2. What was it used for?
- \_\_\_ 3. How far away was the town?
- \_\_\_ 4. What was the engine hooked to?
- \_\_\_ 5. How fast did it go?
- \_\_\_ 6. How long did the trip take?
- \_\_\_ 7. What surprised the people?

## Norms for Word Recognition and Word Analysis

GRADE *	FLASH			ANALYSIS		
	L	M	H	L	M	H
1	5	12	20	7	17	29
2	2	5	8	4	8	13
3	11	14	17	17	21	25
4	21	25	28	29	34	38
5	32	34	36	41	43	45
6	38	41	44	46	47	50

\*Grade 1 — Lists A & B; Grades 2-6 — Lists 1 & 2.

## GRADE 5 READING LEVEL

### Uses of Kites

- \_\_\_ 1. What was this story about?
- \_\_\_ 2. What have kites been used for in war?
- \_\_\_ 3. What did one general use kites for?
- \_\_\_ 4. What was he going to build?
- \_\_\_ 5. What do some people in China make?
- \_\_\_ 6. What are these kites supposed to do?
- \_\_\_ 7. What has the weather bureau used kites for?
- \_\_\_ 8. How high has a string of kites gone?
- \_\_\_ 9. How much can some kites lift?

## GRADE 6 READING LEVEL

### History of Baseball

- \_\_\_ 1. What is called the national sport?
- \_\_\_ 2. What were some of its early names?
- \_\_\_ 3. When was it first played in colleges?
- \_\_\_ 4. What is said about its equipment?
- \_\_\_ 5. What was responsible for its growth?
- \_\_\_ 6. What happened to baseball after the Civil War?
- \_\_\_ 7. What happened in the countries where the soldiers were stationed?
- \_\_\_ 8. Who is said to welcome the baseball season?

## ABOVE GRADE 6 READING LEVEL

### General St. Clair's Defeat

- \_\_\_ 1. What accounted for defeat in the first war waged by the United States?
- \_\_\_ 2. How many men did General St. Clair have?
- \_\_\_ 3. What were they going to do?
- \_\_\_ 4. What did they neglect to do?
- \_\_\_ 5. Where did the Indians attack?
- \_\_\_ 6. What did General St. Clair do then?
- \_\_\_ 7. How many men escaped uninjured?
- \_\_\_ 8. How did President Washington feel about it?

LISTENING COMPREHENSION LEVEL EQUAL TO  
SILENT READING LEVEL OF GRADE \_\_\_\_\_.

## CHECK LIST OF DIFFICULTIES IN WORD RECOGNITION AND WORD ANALYSIS

### WORD RECOGNITION SKILLS (FLASHED WORDS)

- \_\_\_ Low sight vocabulary
- \_\_\_ Will not try difficult words
- \_\_\_ Can spell but not pronounce
- \_\_\_ Ignores word endings
- \_\_\_ Guesses at word from general form

### WORD ANALYSIS

- \_\_\_ Word-analysis ability poor
- \_\_\_ Will not try difficult words
- \_\_\_ Has no method of word analysis
- \_\_\_ Sounds aloud by: single letters — blends — syllables
- \_\_\_ Unable to combine sounds into words
- \_\_\_ Looks away from word after sounding
- \_\_\_ Sounding slow or inaccurate
- \_\_\_ Spells words: successful — inadequate
- \_\_\_ Silent word study: successful — inadequate
- \_\_\_ Enunciates badly when prompted
- \_\_\_ Systematic errors (See tabulation)
- \_\_\_ Names of letters not known
- \_\_\_ Sounds of letters not known
- \_\_\_ Blends not known

# Word Recognition and Word Analysis

**INSTRUCTIONS.** Make a record of correct responses and mispronunciations according to the directions in the Manual.

## GRADE 1 READING LEVEL — LIST A

Flash		Analysis
_____	1. you	_____
_____	2. look	_____
_____	3. little	_____
_____	4. me	_____
_____	5. day	_____
_____	6. tree	_____
_____	7. all	_____
_____	8. come	_____
_____	9. away	_____
_____	10. are	_____
_____	11. run	_____
_____	12. father	_____
_____	13. children	_____
_____	14. morning	_____
_____	15. sleep	_____
_____	16. fish	_____
_____	17. around	_____
_____	18. name	_____
_____	19. chair	_____
_____	20. live	_____

## GRADE 1 READING LEVEL — LIST B

_____	21. rain	_____
_____	22. seen	_____
_____	23. breakfast	_____
_____	24. other	_____
_____	25. hole	_____
_____	26. cry	_____
_____	27. love	_____
_____	28. sister	_____
_____	29. lost	_____
_____	30. joy	_____
_____	31. bark	_____
_____	32. blow	_____
_____	33. please	_____
_____	34. sand	_____
_____	35. tall	_____
_____	36. cover	_____
_____	37. dark	_____
_____	38. afraid	_____
_____	39. place	_____
_____	40. chimney	_____

## GRADES 2-6 READING LEVEL — LIST 1

Flash		Analysis
_____	1. road	_____
_____	2. ground	_____
_____	3. know	_____
_____	4. drink	_____
_____	5. turkey	_____
_____	6. elephant	_____
_____	7. different	_____
_____	8. inch	_____
_____	9. strong	_____
_____	10. stamp	_____
_____	11. fair	_____
_____	12. quickly	_____
_____	13. believe	_____
_____	14. handle	_____
_____	15. bridge	_____
_____	16. speed	_____
_____	17. battle	_____
_____	18. cleaned	_____
_____	19. either	_____
_____	20. quarter	_____
_____	21. guard	_____
_____	22. forgotten	_____
_____	23. crawl	_____
_____	24. tongue	_____
_____	25. single	_____

## GRADES 2-6 READING LEVEL — LIST 2

_____	26. drawn	_____
_____	27. chapter	_____
_____	28. broadcast	_____
_____	29. invent	_____
_____	30. photograph	_____
_____	31. blunt	_____
_____	32. imagine	_____
_____	33. disturb	_____
_____	34. carpenter	_____
_____	35. provide	_____
_____	36. battery	_____
_____	37. ceiling	_____
_____	38. delayed	_____
_____	39. pretend	_____
_____	40. freight	_____
_____	41. championship	_____
_____	42. crowned	_____
_____	43. advertisement	_____
_____	44. prairie	_____
_____	45. blundering	_____
_____	46. shingle	_____
_____	47. wrenches	_____
_____	48. circumstances	_____
_____	49. triumphant	_____
_____	50. thorough	_____

LIST	FLASH		ANALYSIS	
	SCORE	GRADE	SCORE	GRADE
A & B	_____	_____	_____	_____
1 & 2	_____	_____	_____	_____

Letters (Naming Letters —  
Identifying Letters Named —  
Matching Letters)

INSTRUCTIONS. Make a record of errors according to the directions in the Manual.

Letters Named — Identified by Name — Matched

1. D F J H	t m s c
2. S W G O	f j w d
3. M L B T	p n l k
4. C A K V	r h g x
5. N Y E R	u e o i
6. I U P X	a y b v
7. Q Z A C	z q o p

Errors in

1. Naming Letters

CAPITAL \_\_\_\_\_

SMALL \_\_\_\_\_

2. Identifying Letters Named

CAPITAL \_\_\_\_\_

SMALL \_\_\_\_\_

3. Matching Letters

CAPITAL \_\_\_\_\_

SMALL \_\_\_\_\_

4. Writing Letters

CAPITAL \_\_\_\_\_

SMALL \_\_\_\_\_

Visual Memory of  
Words — Primary

INSTRUCTIONS. Ask the child to draw circles around certain letters and words according to the directions in the Manual.

1. y b d g f
2. m h n r t
3. no on imp in nip
4. saw war as was waste
5. girl dog boy dig day
6. won no now mow was
7. lack clock black block dark
8. frost first fast firm trust
9. slat last lost lot blast
10. jump jest just jot must
11. clear clean close climb lean
12. par park trap party quart dark part
13. quiet quick quack point quite question quit
14. state elation tasted station stationed started skating

15. nomination notion mention mountain mountains motion mentioned
16. quarter portion bracelet particle practice practical poultice
17. obscure advice above advise advances dance advance
18. sure obscure scare secure second server cure
19. contact contain contract contracts contacts capital convict
20. immediate meditates mediate mistake meditate material meditative

SCORE \_\_\_\_\_ GRADE \_\_\_\_\_

Norms for Visual Memory of Words — Primary

SCORE	12	15	18
GRADE	1.5	2.5	3.5

Sounds (Hearing Sounds in Words — Sounds in Letters)

Hearing Sounds in Words — Primary

INSTRUCTIONS. Ask the child to draw circles around certain words according to the directions in the Manual.

A.	padlock	vegetable	bacon
1.	tranquil	familiar	vagabond
2.	matter	rapidity	separated
3.	geyser	capitulate	petal
4.	deck	temperature	highway
5.	wisdom	yacht	volcano
6.	gasoline	kaolin	lariat
7.	fault	vein	weight
8.	thorough	favor	tattered
9.	broadcast	blizzard	domestic
10.	choice	confer	classic
11.	thistles	whirled	wisdom
12.	senator	department	stimulant
13.	specimen	caravan	suffer
14.	roster	diamond	drydock
15.	document	poster	plentiful
B.	forehead	crimson	different
16.	crowd	grasp	job

17.	flutter	blood	tug
18.	loss	bantam	lynx
19.	locust	hearty	grief
20.	piccolo	fantastic	benefit
C.	figure	fault	helmet
21.	water	workbench	lurch
22.	frontier	frozen	tradition
23.	davenport	disease	protect
24.	claimed	glistened	glee
25.	bullet	farewell	bushel
26.	helium	happiness	loomed
27.	rusty	radish	foolish
28.	noodles	margin	measles
29.	dreamed	transfer	trampled
SCORE _____		GRADE _____	

Norms for Hearing Sounds in Words — Primary

SCORE	17	22	28
GRADE	1.5	2.5	3.5

Learning to Hear Sounds in Words

m        s        f  
  
t        b        ch  
  
l        p        r

LEARNS SOUNDS  
\_\_\_\_ Easily  
\_\_\_\_ Slowly  
\_\_\_\_ None  
  
NEEDS HELP ON  
\_\_\_\_ Initial Sounds  
\_\_\_\_ Final Sounds

LEARNING RATE  
  
Number of Words Learned \_\_\_\_\_

Sounds of Letters

INSTRUCTIONS. Ask the child to give the sounds of the letters (small) in the list on the opposite page. Point to each letter in turn and say: "What does this say?"

Errors in Sounds \_\_\_\_\_

Ask the child to give the sounds of the phonograms below. Point to each phonogram in turn and say: "What does this say?"

st    ch    th    wh    sh    dr    tr    cl  
  
fr    sm    pl    tw    fl    sk    sw    gr

Errors in Sounds \_\_\_\_\_

# Visual Memory of Words, Spelling, and Handwriting

INSTRUCTIONS. For these tests ask the child to write certain words according to the directions in the Manual.

## Visual Memory of Words — Intermediate

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_
- 8. \_\_\_\_\_
- 9. \_\_\_\_\_
- 10. \_\_\_\_\_
- 11. \_\_\_\_\_
- 12. \_\_\_\_\_
- 13. \_\_\_\_\_
- 14. \_\_\_\_\_
- 15. \_\_\_\_\_

SCORE \_\_\_\_\_ GRADE \_\_\_\_\_

## Phonic Spelling of Words

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_
- 8. \_\_\_\_\_
- 9. \_\_\_\_\_
- 10. \_\_\_\_\_
- 11. \_\_\_\_\_
- 12. \_\_\_\_\_
- 13. \_\_\_\_\_
- 14. \_\_\_\_\_
- 15. \_\_\_\_\_

SCORE \_\_\_\_\_ GRADE \_\_\_\_\_

## Spelling Test

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_
- 8. \_\_\_\_\_
- 9. \_\_\_\_\_
- 10. \_\_\_\_\_
- 11. \_\_\_\_\_
- 12. \_\_\_\_\_
- 13. \_\_\_\_\_
- 14. \_\_\_\_\_
- 15. \_\_\_\_\_
- 16. \_\_\_\_\_
- 17. \_\_\_\_\_
- 18. \_\_\_\_\_
- 19. \_\_\_\_\_
- 20. \_\_\_\_\_

SCORE \_\_\_\_\_ GRADE \_\_\_\_\_

Norms for Visual Memory and Phonic  
Spelling of Words

GRADE	VISUAL MEMORY	PHONIC SPELLING
4	5	7
5	7	9
6	9	11

### CHECK LIST OF DIFFICULTIES

#### VISUAL MEMORY

- \_\_\_ Omits letters; syllables
- \_\_\_ Adds letters; syllables
- \_\_\_ Marked insecurity

#### PHONIC SPELLING

- \_\_\_ Omits sounds; syllables
- \_\_\_ Adds sounds; syllables
- \_\_\_ Incorrect sounds used
- \_\_\_ Marked insecurity

Norms for Spelling Test

GRADE	LIST	
	1	2
2	8	—
3	12	6
4	16	9
5	—	12
6	—	15

### CHECK LIST OF DIFFICULTIES IN SPELLING

- \_\_\_ Omits sounds; syllables
- \_\_\_ Adds sounds; syllables
- \_\_\_ Incorrect sounds
- \_\_\_ Slow handwriting

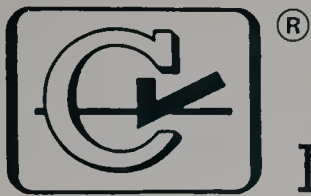
Norms for Handwriting

GRADE	2	3	4	5	6
LETTERS PER MINUTE	25	35	45	55	65

### CHECK LIST OF DIFFICULTIES IN HANDWRITING

- \_\_\_ Speed too slow
- \_\_\_ Poor letter formation
- \_\_\_ Poor position: hand, pencil, paper, body
- \_\_\_ Irregular: height, spacing, slant

HAND USED      \_\_\_ Right      \_\_\_ Left



Lower Primary •

GRADES  
1 and 2 •

Form **W**

# California Achievement Tests Complete Battery

READING — ARITHMETIC — LANGUAGE

**WXYZ SERIES • 1963 NORMS**

DEvised BY ERNEST W. TIEGS AND WILLIS W. CLARK



## TO BOYS AND GIRLS:

This booklet has some games you will like. In taking this first part, you will show how many words you know and how well you can read. Do as many of them as you can.

**DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO.**

**1957 EDITION**

2nd 1963 Printing

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# TEST 1 — SECTION A

**DIRECTIONS:** Look at the words below. If two words are the same or mean the same, write S on the line between them. If they mean different things, write D.

Sample A. dog.....S.....dog

Sample B. sit.....D.....fun

- |                                  |                                        |
|----------------------------------|----------------------------------------|
| 1. made.....made                 | 14. PAT.....RAT                        |
| 2. own.....won                   | 15. LONELY..... <i>lonely</i>          |
| 3. goes.....goes                 | 16. dear.....deer                      |
| 4. open.....open                 | 17. quick.....quack                    |
| 5. was.....saw                   | 18. bat.....tab                        |
| 6. <i>triangle</i> .....triangle | 19. REPORT.....RESORT                  |
| 7. what.....that                 | 20. <i>satisfaction</i> .....satisfied |
| 8. WINDOW..... <i>window</i>     | 21. clearing.....cleaning              |
| 9. MOTHER.....mother             | 22. mouth.....MOUTH                    |
| 10. but.....tub                  | 23. POSTURE.....POSTER                 |
| 11. FATHER.....father            | 24. watch.....witch                    |
| 12. pretense.....present         | 25. tame.....mate                      |
| 13. meadow.....MEADOW            |                                        |

Diagnostic Notes

2

DIRECTIONS: Look at the boxes below. I shall read one word in each box. You are to draw a line under it.

Sample C      Sample D

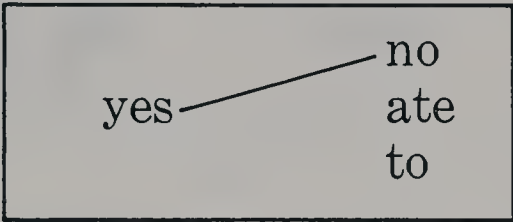
go	<u>ball</u>
<u>have</u>	this
run	come

1. hall rain key	2. green greet greed	3. foot fun full	4. rocket pocket locket
5. will win with	6. thunder plunder blunder	7. swing swim sweet	8. mean main moan
9. tack tall tart	10. Ship Flip Slip	11. BLUE CAP FOX	12. STRING SING STING
13. CHANGE CHANCE CHASE	14. rob rib rub	15. pit pat pet	16. strong throng wrong
17. brain drain train	18. heat hot hum	19. green grain groan	20. treat trout throat

Diagnostic Notes

**DIRECTIONS:** Look at the boxes below. See the words with numbers in front of them. Draw a line from each of these words to the word on the other side which means the opposite.

Sample E

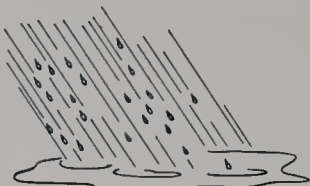
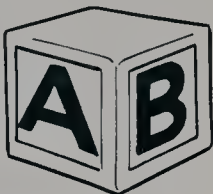




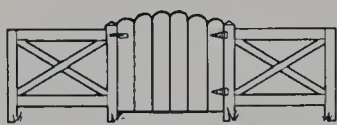




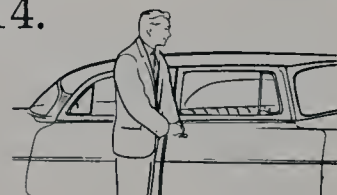

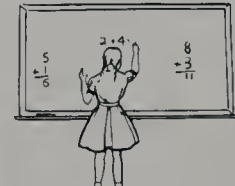



1. grandfather	uncle grandmother man
2. day	night walk time
3. backward	forward around outside
4. aunt	uncle mother woman
5. came	first went last
6. north	south east west
7. before	thus gone after
8. lost	took walk found

9. public	private many open
10. old	worn one new
11. top	above under bottom
12. begin	work end play
13. catch	fast throw hard
14. rough	hands animal smooth
15. sad	sorry mad glad

4

**DIRECTIONS:** Look at the boxes below. In each box is a picture and some words opposite it. Draw a line under the word or words that mean the same as the picture.

1.		rain pain gain	9.		black block bleak
2.		bet bear beat	10.		around the house inside the house outside the house over the house
3.		bat bet tab	11.		under the school on the school into the school out of the school
4.		gate mate hate	12.		under the house on the house out of the house into the house
5.		sail pail nail	13.		before the desk below the desk around the desk inside the desk
6.		card cash cans	14.		behind the car below the car beside the car around the car
7.		blow bee bit	15.		below the blackboard before the blackboard beside the blackboard behind the blackboard
8.		hard hurt hand			

**DIRECTIONS:** Look at the sentences and stories below. Do what the sentences say and do what it says under each story.

**SENTENCES**

- 1. Write the missing letter in this word:  
d\_\_g            dog
- 2. Write the missing letters in this word:  
quac\_\_            quacks
- 3. Draw a line under one of the words below:  
good      duck      like      cold
- 4. Write a word that begins with **d**.  
\_\_\_\_\_
- 5. Cross out a letter to make **on** out of  
this word: **ton**

Diagnostic Notes

**STORY**

Roy plays with the cow.  
The cow's name is Spotty.  
Nancy plays with a goat.  
Its name is Blacky.

**✓ Draw a line under the right word:**

- 6. Roy plays with a  
dog.            goat.            cow.
- 7. Blacky is the name of a  
goat.            horse.            cow.
- 8. Spotty is the name of a  
horse.            kitten.            cow.
- 9. The goat belongs to  
Nancy.            Roy.            Father.

Mrs. Turtle, Mr. Frog, and Yellow Duck went to the brook. They saw many good things to eat. Mr. Frog got some bugs. Yellow Duck liked corn best.

✓ Draw a line under the right word:

10. The story tells about  
animals. children. toys.
  11. They were at the  
barn. brook. house.
  12. The bugs were eaten by  
Yellow Duck. Mrs. Turtle. Mr. Frog.
  13. Yellow Duck liked the  
cabbage. corn. bugs.
- 

"Good afternoon, little girl," said the policeman. "May I help you?"

"I want to go to the park. I cannot find my way," said Nancy. "Please help me."

✓ Draw a line under the words that tell how the story ends.

14. The policeman said,  
"Call your mother to take you."  
"I am in a hurry."  
"I will take you to the park."
- 

The mice played in the barn and ate the farmer's corn. The cat came to the barn.

✓ Draw a line under the words that tell how the story ends.

15. Then the mice  
went on eating.  
ran to their home.  
ran to the cat.

LETTER RECOGNITION

DIRECTIONS: Look at the letters below. Now put your finger under the first letter on the first line. Find another letter on the line that is the same as the first one. Draw a ring around it.

Sample F. w.....r o w u

- 1. u.....o e n u
- 2. v.....u y r v
- 3. x.....i k x t
- 4. g.....y p g q
- 5. p.....d p b g
- 6. b.....h p d b
- 7. P.....P D J R
- 8. S.....Z O E S
- 9. V.....W V U Z
- 10. N.....N K Z M
- 11. Q.....G Q C O
- 12. Z.....Z N T U
- 13. c.....C A S G
- 14. u.....C R U Q
- 15. e.....F Q A E
- 16. h.....H F M R
- 17. n.....M H N K
- 18. d.....B P D O
- 19. Y.....g z j y
- 20. U.....u q v r
- 21. A.....e c a o
- 22. M.....r m n v
- 23. R.....n r v m
- 24. L.....m l t f

Diagnostic Notes



## Arithmetic

### TO BOYS AND GIRLS:

The games in this part of the booklet will show how well you can think and work problems. Do as many of them as you can.

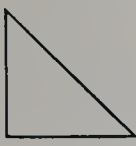

**DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO.**









**DIRECTIONS:** Listen to the directions as I read them. Then do what I tell you to do.

Samples

Diagnostic Notes

A.		2
B.		1

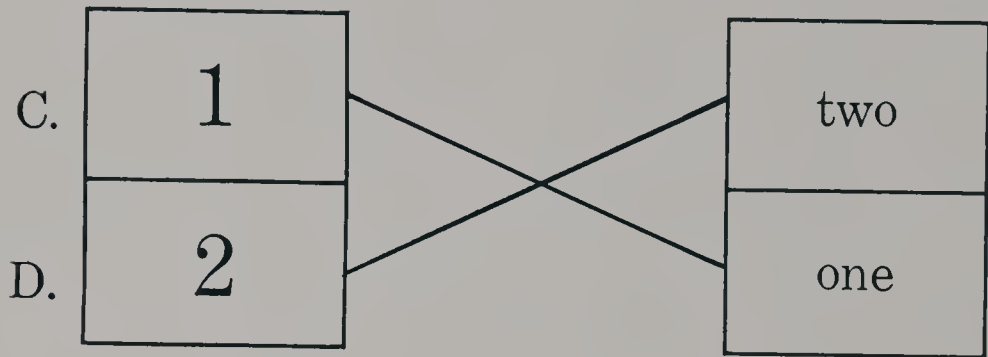
1.	 	8
2.	 	5
3.	 	3
		7
		6
		4

2

DIRECTIONS: Listen to the directions as I read them. Then do what I tell you to do.

Samples

Diagnostic Notes



4.	3	four
5.	8	five
6.	6	ten
7.	4	nine
8.	9	eight
9.	5	three
		seven
		six

3

**DIRECTIONS:** On this page are a few problems. Listen while I read them to you.

Diagnostic Notes

10. There are \_\_\_\_\_ pigs.



11. There are \_\_\_\_\_ birds.

12. Write the numbers that are left out.

1 \_\_\_\_\_ 3 \_\_\_\_\_ 5 6 7 \_\_\_\_\_ 9 10

✓ Draw a circle around the larger number in each box.

13.

7
11

14.

23
16

15.

47
52

✓ Write the number that means the same as each word.

16. six\_\_\_\_\_

17. eighteen\_\_\_\_\_

18. twenty-four\_\_\_\_\_

19. one hundred five\_\_\_\_\_

20. Write the numbers that are left out.

10 \_\_\_\_\_ 30 40 \_\_\_\_\_ 70 80

4

**DIRECTIONS:** Listen to the directions as I read them. Then do what I tell you to do.

✓ Draw a line under the right answer.

Diagnostic Notes

21. 10 pennies are the same as { 1 nickel.  
1 quarter.  
1 dime.

22. 10 dimes are the same as { 1 quarter.  
1 nickel.  
1 dollar.

23. 1 dollar is the same as { 4 quarters.  
4 half dollars.  
4 dimes.



24. The time is \_\_\_\_\_ o'clock.



25. The time is \_\_\_\_\_ o'clock.

✓ Draw a line under the right answer.

26. lemons      rice      corn      potato chips

27. 6 pounds      35 pounds  
52 pounds      106 pounds

28. 3 minutes      10 minutes  
20 minutes      30 minutes

29.    

30. 7 ft.      \$7      7¢      7 yrs.

# TEST 3—SECTION B

**DIRECTIONS:** Listen to the directions as I read them. Then do what I tell you to do.

1. 8 chicks  
5 chicks

9. 5 pounds  
2 pounds

Diagnostic Notes

2. 7 rulers  
5 rulers

10. 10 pounds

3. 5 cents  
2 cents

11. 1 pear

4. 2 boxes  
5 boxes  
1 box

12. 10 cents  
6 cents

5. 5 cookies  
1 cookie  
2 cookies

13. 7 rabbits  
4 rabbits  
2 rabbits

6. 8 pupils  
6 pupils

14. 10 cents  
4 cents  
2 cents

7. 5 pieces  
1 piece  
3 pieces

15. 2 pounds

8. 5 apples

6

**DIRECTIONS:** Look at these problems. You are to add the numbers each time and write your answer under them.

1. 
$$\begin{array}{r} 2 \\ + 1 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 3 \\ + 3 \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 1 \\ + 4 \\ \hline \end{array}$$

4. 
$$\begin{array}{r} 5 \\ + 2 \\ \hline \end{array}$$

5. 
$$\begin{array}{r} 4 \\ + 4 \\ \hline \end{array}$$

Diagnostic Notes

6. 
$$\begin{array}{r} 3 \\ + 0 \\ \hline \end{array}$$

7. 
$$\begin{array}{r} 6 \\ + 2 \\ \hline \end{array}$$

8. 
$$\begin{array}{r} 9 \\ + 0 \\ \hline \end{array}$$

9. 
$$\begin{array}{r} 4 \\ + 2 \\ \hline \end{array}$$

10. 
$$\begin{array}{r} 1 \\ + 7 \\ \hline \end{array}$$

11. 
$$\begin{array}{r} 5 \\ + 0 \\ \hline \end{array}$$

12. 
$$\begin{array}{r} 8 \\ + 2 \\ \hline \end{array}$$

13. 
$$\begin{array}{r} 4 \\ + 5 \\ \hline \end{array}$$

14. 
$$\begin{array}{r} 8 \\ + 1 \\ \hline \end{array}$$

15. 
$$\begin{array}{r} 3 \\ + 5 \\ \hline \end{array}$$

16. 
$$\begin{array}{r} 7 \\ + 1 \\ \hline \end{array}$$

17. 
$$\begin{array}{r} 3 \\ + 6 \\ \hline \end{array}$$

18. 
$$\begin{array}{r} 0 \\ + 1 \\ \hline \end{array}$$

19. 
$$\begin{array}{r} 7 \\ + 2 \\ \hline \end{array}$$

20. 
$$\begin{array}{r} 9 \\ + 3 \\ \hline \end{array}$$

21. 
$$\begin{array}{r} 13 \\ + 5 \\ \hline \end{array}$$

22. 
$$\begin{array}{r} 6 \\ + 17 \\ \hline \end{array}$$

23. 
$$\begin{array}{r} 25 \\ + 30 \\ \hline \end{array}$$

24. 
$$\begin{array}{r} 15 \\ + 34 \\ \hline \end{array}$$

25. 
$$\begin{array}{r} 28 \\ + 33 \\ \hline \end{array}$$

7

**DIRECTIONS:** Look at these problems. You are to subtract, or take away, in each problem and write your answer under it.

1. 
$$\begin{array}{r} 0 \\ - 0 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 3 \\ - 2 \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 9 \\ - 0 \\ \hline \end{array}$$

4. 
$$\begin{array}{r} 6 \\ - 5 \\ \hline \end{array}$$

5. 
$$\begin{array}{r} 7 \\ - 0 \\ \hline \end{array}$$

Diagnostic Notes

6. 
$$\begin{array}{r} 6 \\ - 4 \\ \hline \end{array}$$

7. 
$$\begin{array}{r} 3 \\ - 1 \\ \hline \end{array}$$

8. 
$$\begin{array}{r} 4 \\ - 4 \\ \hline \end{array}$$

9. 
$$\begin{array}{r} 8 \\ - 3 \\ \hline \end{array}$$

10. 
$$\begin{array}{r} 9 \\ - 6 \\ \hline \end{array}$$

11. 
$$\begin{array}{r} 7 \\ - 5 \\ \hline \end{array}$$

12. 
$$\begin{array}{r} 1 \\ - 1 \\ \hline \end{array}$$

13. 
$$\begin{array}{r} 8 \\ - 5 \\ \hline \end{array}$$

14. 
$$\begin{array}{r} 9 \\ - 3 \\ \hline \end{array}$$

15. 
$$\begin{array}{r} 8 \\ - 2 \\ \hline \end{array}$$

16. 
$$\begin{array}{r} 18 \\ - 4 \\ \hline \end{array}$$

17. 
$$\begin{array}{r} 48 \\ - 28 \\ \hline \end{array}$$

18. 
$$\begin{array}{r} 35 \\ - 30 \\ \hline \end{array}$$

19. 
$$\begin{array}{r} 47 \\ - 35 \\ \hline \end{array}$$

20. 
$$\begin{array}{r} 45 \\ - 37 \\ \hline \end{array}$$



## Language

### TO BOYS AND GIRLS:

The games in this part of the booklet will show what you know about capital letters, periods, commas, and so forth, and how well you can spell. Do the best you can.

**DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO.**



1

**DIRECTIONS:** Below are some sentences. You are to make an X on each word (not already capitalized) that should start with a capital letter.

Diagnostic Notes

1. We heard jim.
2. My parrot's name is polly.
3. May i play a game?
4. when will you leave?
5. we are walking to school.
6. Fall starts in september.
7. We don't have school on saturday.
8. Do you like mary?
9. Mother baked a pie last tuesday.
10. My family comes from seattle.
11. May i have some cake?
12. We can swim in july.
13. My dad stayed in cleveland.
14. I love my little dog, spot.
15. I know that baltimore is a city.
16. Shall i read it?
17. did you close the door?
18. It often rains in october.
19. Do you think i should go?
20. my grandmother has gone on a trip.

2

**DIRECTIONS:** Below are some sentences and a story. You are to write in the  
 periods (.)  
 commas (,)  
 question marks (?)  
 that have been left out of the sentences and the story.

**SENTENCES**

Diagnostic Notes

1. He is lazy
2. Should we run
3. I help my mother very often
4. Where is your cat
5. We like school
6. Susan lives in Eugene Oregon.
7. Who sent you here
8. I am drying dishes
9. We went to see Dr Brown.
10. Will you go to the zoo
11. I walked with Mark Jim, and Ray.
12. Have you seen my new bicycle
13. He finished on March 11 1956.
14. How did you hurt your finger
15. The date was Aug 30.
16. My brother asked me for a bat a mask,  
and a glove.

**STORY**

17. Mary got a package for her birthday
18. In it were apples peaches, and cherries.
19. Do you think Mary liked her present
20. Yes, she said that she liked it very much

3

**DIRECTIONS:** Each sentence below has two words placed one above the other. You are to make an X on the one which you think is correct in each sentence.

Diagnostic Notes

1. He  $\left\{ \begin{array}{l} \text{are} \\ \text{is} \end{array} \right\}$  my cousin.
2. Can you  $\left\{ \begin{array}{l} \text{go} \\ \text{went} \end{array} \right\}$  out now?
3. Beth  $\left\{ \begin{array}{l} \text{come} \\ \text{came} \end{array} \right\}$  home and cried.
4. We  $\left\{ \begin{array}{l} \text{were} \\ \text{was} \end{array} \right\}$  told to sit down.
5. Mark read the poem  $\left\{ \begin{array}{l} \text{too} \\ \text{to} \end{array} \right\}$  the class.
6. My sister  $\left\{ \begin{array}{l} \text{am} \\ \text{is} \end{array} \right\}$  six years old.
7. I have read  $\left\{ \begin{array}{l} \text{those} \\ \text{them} \end{array} \right\}$  books before.
8. She  $\left\{ \begin{array}{l} \text{were} \\ \text{was} \end{array} \right\}$  a nice girl.

9. He  $\left\{ \begin{array}{c} \text{run} \\ \text{ran} \end{array} \right\}$  all the way to school.

10. She  $\left\{ \begin{array}{c} \text{see} \\ \text{saw} \end{array} \right\}$  the cow in the barn.

11. I  $\left\{ \begin{array}{c} \text{am} \\ \text{are} \end{array} \right\}$  a good pupil.

12. A man  $\left\{ \begin{array}{c} \text{came} \\ \text{comed} \end{array} \right\}$  to the door.

13. I didn't hear  $\left\{ \begin{array}{c} \text{no} \\ \text{any} \end{array} \right\}$  noise.

14. There  $\left\{ \begin{array}{c} \text{were} \\ \text{was} \end{array} \right\}$  no ducks on the lake.

15. I try not to talk  $\left\{ \begin{array}{c} \text{too} \\ \text{two} \end{array} \right\}$  much.

16. Is  $\left\{ \begin{array}{c} \text{this here} \\ \text{this} \end{array} \right\}$  your pencil?

17. He  $\left\{ \begin{array}{c} \text{can} \\ \text{may} \end{array} \right\}$  read very well.

18. She will give me  $\left\{ \begin{array}{l} \text{them} \\ \text{these} \end{array} \right\}$  dolls.
19. We have  $\left\{ \begin{array}{l} \text{run} \\ \text{runned} \end{array} \right\}$  many blocks.
20. When  $\left\{ \begin{array}{l} \text{can} \\ \text{may} \end{array} \right\}$  I come again?
21. She  $\left\{ \begin{array}{l} \text{doesn't} \\ \text{don't} \end{array} \right\}$  read well.
22. She and  $\left\{ \begin{array}{l} \text{I} \\ \text{me} \end{array} \right\}$  are good friends.
23. I just  $\left\{ \begin{array}{l} \text{began} \\ \text{begun} \end{array} \right\}$  my lessons.
24. I have just  $\left\{ \begin{array}{l} \text{wrote} \\ \text{written} \end{array} \right\}$  a poem.
25.  $\left\{ \begin{array}{l} \text{Isn't} \\ \text{Aren't} \end{array} \right\}$  most houses painted white?

4

DIRECTIONS: Write the words that are pronounced.

1. _____	11. _____
2. _____	12. _____
3. _____	13. _____
4. _____	14. _____
5. _____	15. _____
6. _____	16. _____
7. _____	17. _____
8. _____	18. _____
9. _____	19. _____
10. _____	20. _____





FOR USE WITH 1963 NORMS

# California Achievement Tests

## Lower Primary • GRADES 1 and 2 • Form

DIAGNOSTIC PROFILE SHEET

DEvised BY ERNEST W. TIEGS AND WILLIS W. CLARK

Name

Last

First

Middle

School

City

Teacher or Examiner

Boy ☐ Girl ☐ Grade (Circle one)

Date of Test

Year

Month

Day

Date of Birth

Year

Month

Day

Pupil's Age

Years

Months

Total Mos.

### READING

#### 1. READING VOCABULARY

#### 2. READING COMPREHENSION

#### 3. ARITHMETIC REASONING

#### 4. ARITHMETIC FUNDAMENTALS

#### 5. MECHANICS OF ENGLISH

#### 6. SPELLING

### LANGUAGE

A. Word Form

B. Recognition

C. Meaning of Opposites

D. Picture Association

(A + B + C + D)

TOTAL READING COMPREHENSION

A. Meanings

B. Problems

(A + B)

TOTAL

C. Addition

D. Subtraction

(C + D)

TOTAL ARITHMETIC

A. Capitalization

B. Punctuation

C. Word Usage

(A + B + C)

TOTAL SPELLING

TOTAL LANGUAGE

TOTAL BATTERY

Grade Placement

AAGP\*

Other Score†

Raw Score

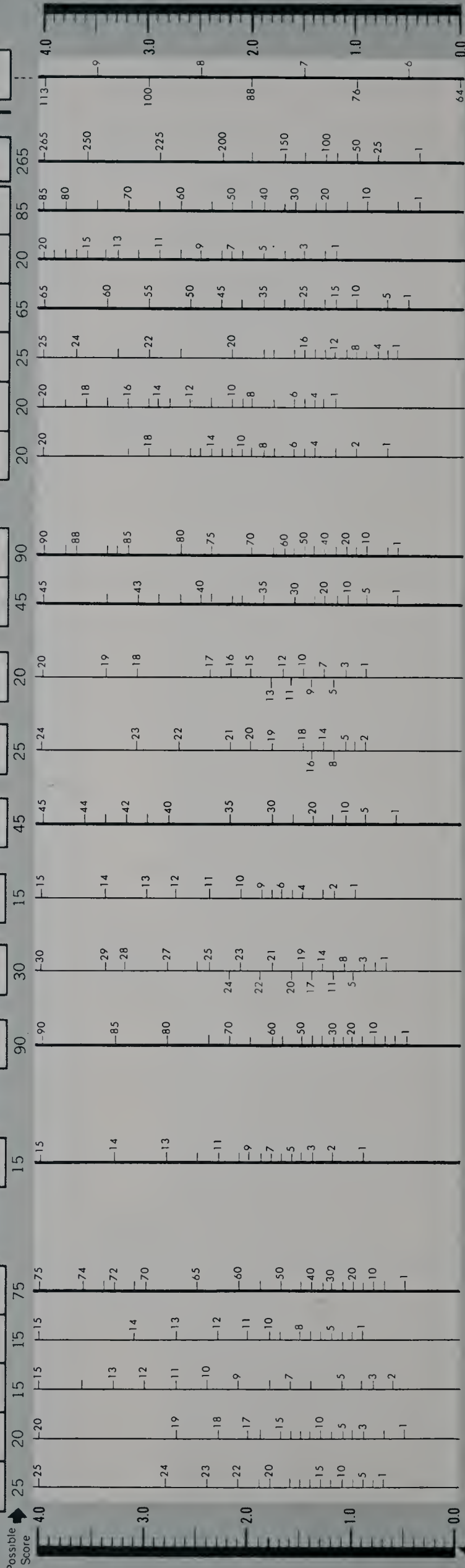
Possible Score

AGP

ISI

GCA

CA



Grade Placement

Grade Placement

\*Anticipated Achievement Grade Placement, based on Intellectual Status Index (I.S.I.); see Manual.

†Percentile, standard score, stanine (circle score used).

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